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OPTIMIZATION WAYS TO THE MORPHOLOGICAL DIAGNOSIS OF VARIOUS MYOCARDIAL INFARCTION TYPES

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At present, there are five types of myocardial infarction, depending on the mechanism of disease development, which is consistent with the IV universal definition of myocardial infarction (MI). This article provides a clinical anatomical analysis of 90 cases of various types of MI. Diagnostic features and the incidence of myocardial infarction were evaluated from a clinical and pathological point of view.

In patients with all types of myocardial infarction, a comorbid pathology was recorded, more often with types 2 and 3 of the disease – diabetes mellitus, hypertension, and others. In clinical anatomical analysis, in the interests of the final (posthumous) diagnosis of the indicated types of MI, it is important to have data from intravital studies to compare with the results of the organ section. Under these conditions, the morphometric characteristics of the heart with various types of MI are of particular importance.

Keywords: myocardial infarction, types of myocardial infarction, clinical and pathological analysis.

Introduction. Diseases of the circulatory system occupy a significant place in the doctor's practice [2, 3, 6], and often the initial cause of death is myocardial infarction (MI) [5, 6, 8, 9]. In the Russian Federation and federal districts, myocardial infarction is not most often diagnosed [4]. Moreover, in leading clinics in the world, mortality in this disease is 5-7% [7]. As part of coronary heart disease, myocardial infarction (MI) is largely due to stenotic sclerosis of the coronary arteries [1, 2, 5, 6, 9]. As a rule, the cause of the development of myocardial infarction is a complicated unstable atherosclerotic plaque of the coronary artery of the heart [1, 2, 9]. Complicated unstable atherosclerotic plaque as a combined concept includes: hemorrhage in a plaque; erosion and tears, stratification of the tire, thrombosis and thromboembolism of the distal parts of the affected arteries [2]. According to the "Fourth universal definition of acute myocardial infarction" [9], 5 types of disease are distinguished. At the same time, the authors pay considerable attention to the pathoanatomical diagnosis of acute coronary (sudden) death, MI 2 and 3 types.

Materials and methods. The basis of the work is 90 observations of myocardial infarction, taking into account the types of disease in accordance with the IV Universal Definition of MI [9]. The studies were carried out on the basis of the Central pathoanatomical department of State budgetary institutional of Healthcare of City clinical hospital of RB No. 21 from 2017 to 2018. At the same time, an anamnesis was studied, ECG, Echo-KG data in dynamics, general analysis of blood and urine, indicators of a number of enzymes (KFK-MV, LDH, ALT, AST, ALP), coagulograms, blood biochemistry. An important place in the diagnosis of myocardial infarction is occupied by the determination of the cardiospecific biomarker of troponin, especially fractions I and T. In myocardial infarction, the full pathological autopsy was performed using traditional methods and our modification. At autopsy, a thorough study of the vessels and separate weighing of the departments of the organ were carried out. During the study of the heart, macro-, micromorphometric indicators were taken according to a certain plan. Histological sections were stained with hematoxylin-eosin, according to Mallory, Van Gieson, Masson. To perform the necessary statistical processing of the material, a database was created in the form of static table files using the capabilities of the Statistica 6.0 program (StatSoftInc., USA).

Results and discussion. Those who died from myocardial infarction were between the ages of 42 and 88, with men and women equally distributed (45). Initially, the distribution of types was made according to the results of intravital studies. Moreover, type 1 MI was detected in 28, type 2 in 14, type 3 in 33, type 4 in 4, type 4 in 4, type 4 in 6, type 5 in 1 case. Types of MI according to pathological criteria were distributed as follows: type 1 - 22, type 2 - 37, type 3 - 0, 4a - 2, 4b - 6, 4s-21 and type 5 - 1 case. The largest number of subjects were 75 years of age or older. Acute myocardial infarction in all its types was frequent (85.6%) in old age. It should be noted that MI up to 59 years was registered only in 13 (14.4%) people. In women, type 2 MI was detected 10 times. It is noteworthy that with type 3 MI (33), the distribution of men and women followed equally. Type 4 myocardial infarction was determined in 14 people, and on the "a", "b", "c" variants accounted for 4.4.6 cases, respectively. Only type 5 MI occurred in one deceased. The collection of sectional material continues, which will allow for a more thorough clinical and anatomical analysis in the future, including for types 4 and 5. The criteria for distinguishing types of MI were the results of clinical, radiological, functional, laboratory, instrumental and pathological studies.

For greater clarity, the subjects examined by sex and age composition and types of MI are presented in the diagram (Fig. 1). It was established that type 1 myocardial infarction is most characteristic for men older than 75 years, and type 2 disease was observed mainly in senile age in women. Type 3 myocardial infarction occurred equally often in men (17) and women (16). In women, myocardial infarction was more common over the age of 75 years (62.5%). In men, type 3 MI was detected at the age of 42-88 years. Among them, with 3 types of MI up to 75 years old, there were 13, over 75 years old - 4 people. Short-term hospital stay (up to 1 day) was observed in 77 (85.5%) cases. In the clinic, 2-3 bed days spent 3, 4-6 bed days - 8 and more than 7 - 2. In the history of people with type 1 MI, information about coronary heart disease was absent in 17.8%, type 2 MI 21.4%, 3-type MI in 12% of cases. A history of denial of coronary heart disease has often been established in individuals younger than 59 years of age in 22% of cases. Post-infarction cardiosclerosis was determined at autopsy, which did

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not previously appear in history or was not detected with instrumental methods of research. Diabetes mellitus, hypertension, cerebrovascular disease, chronic obstructive pulmonary disease, chronic renal failure, anemia of various origins and cardiac arrhythmias were more characteristic for patients with MI 2 and 3 types, which were listed as background or concomitant diseases. Hypertension was more often observed in the MI group of types 1.3 and 4. For all types of MI, hemoglobin was reduced, especially in the group with type 3 disease (an average of 122.5 g / l), the erythrocyte content in the blood fluctuated on average 4.3-4.9 * 1012 / l. At the same time, a high content of red blood cells was noted with type 3 myocardial infarction (4.9 * 1012 / l), which was largely explained by blood clotting and manifestations of the dehydration of the body. A biochemical blood test showed high creatinine, when its concentration ranged from 69.3 to 210.5 μmol / L. A high concentration of creatinine was of a nature for individuals of 1,2,3 types of MI. At the end of the disease, there was a negative increase in indicators of general analysis and blood biochemistry, including those confirming a sharp violation of homeostasis of body fluids. On the ECG, ST segment elevation was observed only in 42% of cases of type 3 MI, while other types of MI were detected more often. With type 1 MI, the ST segment elevation was determined in 71%, type 2 in 57%, and type 4 in 85% of observations. With type 4 MI, the clinic performed angiography in 100% of cases. At the same time, with other types of MI, angiography was used much less frequently. Troponin values exceed normal values (> 99th percentile of the upper reference index) for types 1, 4b, and 4c of MI. High rates of troponin were determined in 92.8% for type 1, in 78.6% for type 2 and in 100% of cases for types 4 and 5. The cardiospecific biomarker troponin was predicted to be low in type 2 MI. A similar dynamics was observed in the study of CPK-MV, and for all types of MI, it ranged from 41.8-94 units / liter. In 45 cases, damage to the coronary artery was observed in the form of thrombosis, hemorrhage in the fibrous plaque, stratification and erosion with complete or partial occlusion. Such pathological changes were most often found on the anterior interventricular artery (MAD) (25), then in the descending direction, the right coronary artery (PCA) (10) and the envelope of the artery (OA) (10). Thrombosis was detected at the site of damage to the intima with the destruction of the superficial tire of the fibrous plaque, hemorrhage and narrowing of the lumen of the vessel. When morphologically assessing the degree of atherosclerotic lesion of the coronary arteries, the following gradation was used: narrowing of the lumen of the artery to 25%, 50%, 75% [3]. Narrowing of the lumen of blood vessels without damage to the fibrous plaque was found in half of the observations. In this case, severe stenosing coronarosclerosis without damage to the intima of the vessel (stable fibrous plaque) was recognized as the cause of acute myocardial infarction. In type 1 MI, stenosis was more often recorded in permanent residence (55.7%), somewhat less frequently in OA (48.8%) and PKA (46.5%). Multivascular damage to the coronary arteries of the heart with limiting stenosis was found to be characteristic of types 2 and 4 (Table 3). In case of myocardial infarction of type 4c, an unstable atherosclerotic plaque in the vessels of the organ was presented as follows: PMA-40%, OA-40%, PKA-20%. Most often, an atherothrombotic lesion was detected in permanent residence - 55.5% (Table 4).

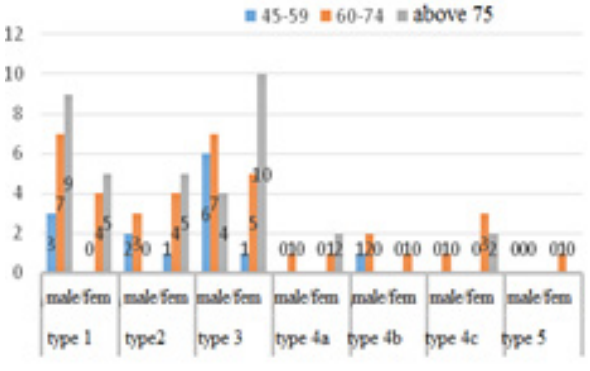

Fig.1. The distribution of types of myocardial infarction in men and women by age. On the abscissa axis there are types of MI; on the ordinate axis is the number of cases.

In our observations, transmural MI prevailed (18). Other localizations, namely intramural (15), subendocardial (7), and suepicardial MI (3) were recorded somewhat less frequently. In this case, IM 4c type was more common with lesions of each of the localizations presented. The average area of the infarcted zone was 28.3 ± 21.2 cm2, and with transmural MI, it was 44.9 ± 21.9 cm2. A recurrent course of MI was recorded in 66% of cases with visible necrosis of the heart muscle of various localization and area. The necrosis zone was mottled with foci of yellowish-brown color. When studying a series of micropreparations, along with the foci of a homogeneous, structureless and eosinophilic mass, bordering zones of granulations were found. In the designated area, significant areas of hemorrhage could be detected due to erythrodiapedesis an area of demarcation inflammation adjacent to necrosis was detected with an abundance of inflammatory cellular elements. Acute myocardial infarction in the anterior wall of the left ventricle (LV) was detected in 3, the lower wall of the left ventricle in 3

Table 1

Distribution of nosological forms identified from the anamnesis depending on the type of MI

Nosological forms identified from the anamnesis	Types of acute myocardial infarction						
	1 type	2 type	3 type	4a type	4b type	4c type	Total
Hypertonic disease, n	18	9	28	3	2	5	65
Diabetes, n	4	8	8	1	0	1	22
Coronary heart disease, n	23	11	29	4	4	6	77
- Postinfarction cardiosclerosis, n	6	3	10	1	0	0	20
- Chronic left ventricular aneurysm, n	2	0	3	0	0	0	5
- Small focal diffuse cardiosclerosis, n	10	1	15	2	1	1	30
Cerebrovascular disease, n	2	3	3	0	0	1	9
History of rhythm disturbance, n	2	1	6	0	0	0	9
Malignant neoplasms, n	1	0	0	0	0	0	1
Анемии различного генеза, n	2	2	9	1	0	2	16
Digestive system diseases, n	2	1	2	0	0	1	6
Chronic obstructive pulmonary disease, n	0	1	3	0	1	0	5
Chronic renal failure, n	1	3	7	0	0	1	12
Total	28	14	33	4	4	6	89

Note: one case of type 5 MI is not included in the table.

Table 2

The characteristics of the sectional material by types of MI and the results of laboratory and instrumental studies

Laboratory and instrumental research indicators	Types of IM					
	1 type	2 type	3 type	4a type	4b type	4c type
GBT: Hemoglobin, g/l	127.3(86-170)	134.1(105-162)	122.5(62-160)	130.8(106-141)	132.6(125-139)	133.4(103-166)
RBC, *1012/l	4.3(2.6-5.9)	4.48(3.1-5.39)	4.9(2.6-21.2)	4.5(3.66-5)	4.4(4-4.99)	4.4(3.2-5.2)
WBC, *109/l	14.6(5.3-31.7)	14.2(7.2-27.9)	12.3(4.8-24.2)	14.3(8.1-24.2)	10.3(7.2-16.9)	19.9(6.8-29)
CAB: CPhK-MB, U/l	68.6(25-271)	41.8(10-93)	66.2(19-184)	53.3(23-83)	94(53-119)	50.5(20-147)
Creatinin, mmole/l	150.9(58-755)	210.5(68-658)	153.1(66-364)	81.7(51-120)	91(74-108)	69.3(64-158)
Troponin pg/ml	2596.5(134.3-10000)	62.9(13.37-120.1)	0	651.4(51.48-1251)	745.3(531.5-982.1)	3124.4(294.7-10000)
ECG: segment lift ST, n	20	8	14	3	4	5
Appearance of pathologic wave Q, n	3	2	0	1	2	2
Fibrillation, n	12	3	15	2	3	1
Echo-CG: left ventricular ejection fraction, %	45.5	47.8	49	0	44	51.7
Angiography, n	10	3	3	4	4	6

Note: CAB is a general blood test. B / Ch - blood biochemistry. ECG - electrocardiography. Echocardiography - echocardiography. In the indicators KLA and b / ch blood indicated average values.

observations (Fig. 2). Moreover, a combination of necrotic changes in the heart muscle in various parts of the organ was a characteristic phenomenon. In the anterior-septal region, myocardial infarction was detected in 16, the posterior-septal region - 9, the circular - in 9, the anteroposterior - in 2 cases. It has been established that damage to the anterior septal region of the left ventricle of the heart is most characteristic of type 4c MI (8). Necrosis in the lower wall of the left ventricle was more common in type 2 MI.

Conclusion: Myocardial infarction was mainly transmural in nature (42%) with a lesion area of 44.9 ± 21.9 cm2 on average. In type 1 myocardial infarction, moderate and severe degree of narrowing was detected in permanent residence (55.7%). Types 2 and 4 of myocardial infarction are characterized by a multivascular lesion in the PMA, OA, and PKA systems with significant stenotic coronary sclerosis (56.1-62.5%). Unstable atherosclerotic plaque with secondary complications was detected in half (45) cases of MI. The latter was more often registered in permanent residence with type 1 disease (80%). According to localization, a mixed type of MI was more common, and the anterior-septal localization was characteristic for type 4c, the lower wall of the left ventricle for type 2 of the disease. Myocardial infarction in 37.2% was localized in the anterior-septal region of the left ventricle. For a clear clinical and anatomical analysis of MI, it seems appropriate to subdivide myocardial infarction into the corresponding types. The greatest difficulty is observed in the characterization of types 2 and 3 of MI. With type 1, this disease most often occurs in men older than 75 years, with type 2 in women of old age. In most (77) cases, a short stay of the examined in the clinic was noted (less than 24 hours), which largely explains a slight deviation from the examination protocol. In some cases, there are no indicators of troponin, KFK-MV and other enzymes, ECG in dynamics, ECHO-KG data and angiography are not presented. In patients

Table 3

The distribution of types of MI depending on the degree of stenosis of the coronary arteries of the heart

Types IM	Coronary arteries of the heart with areas of stenotic fibrous plaque		
	AIVA, %	CA, %	ПКА, %
1 type	55.7	48.8	46.5
2 type	56.1	54.1	48.7
4b type	62.5	54.1	54.1
4c type	56.8	60.8	52.2

Note: 4a and 5 types are not included in the table (for one case)

Table 4

Coronary arteries of the heart with patches of unstable fibrous plaque

Types IM	Coronary arteries of the heart with patches of unstable fibrous plaque			
	AIVA, n	CA, n	RCA, n	Total
1 type	20	7	9	36
2 type	0	0	0	0
4b type	3	1	0	4
4c type	2	2	1	5
Total	25	10	10	45

Note: a complication of unstable atherosclerotic plaque is rupture, hemorrhage, erosion of a fibrous plaque with the formation of a blood clot in the lumen of the vessel, thrombo-atheroembolism of the distal parts of the same artery (according to Zairatyants O.V., Kaktorsky L.V., 2014)

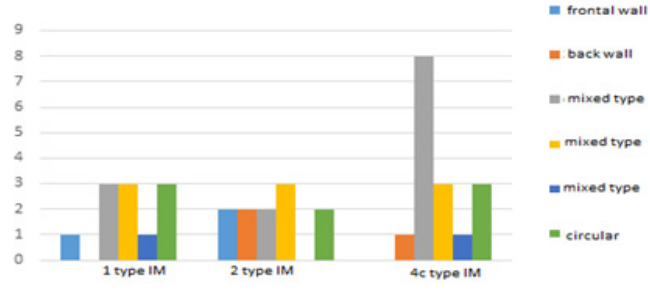

Fig. 2. Distribution of MI types by localization of damage to the heart muscle.

with all types of myocardial infarction, a comorbid pathology was recorded, more often with types 2 and 3 of the disease - diabetes mellitus, hypertension, and others. In clinical anatomical analysis, in the interests of the final (posthumous) diagnosis of the indicated types of MI, it is important to have data from intravital studies to compare with the results of the organ section. Under these conditions, the morphometric characteristics of the heart with various types of MI are of particular importance.

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