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Research Article

Changes of the Myocardium at the Ischemic Cardiomyopathy in Morphometric Lighting

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Abstract

By a morphometric method of research the pathologic changes of the myocardium in ischemic cardiomyopathy was determined. The analysis of the obtained results shows that in the process of morphogenesis of this disease develop the deep dystrophic-degenerative, sclerotic and to a much lesser extent compensatory-adaptive structural changes of myocardium.

Keywords: *Ischemic Cardiomyopathy; Pathomorphology of Myocardium; Morphometry*

Introduction

Ischemic cardiomyopathy (ICMP) is a myocardial lesion caused by diffuse, significantly pronounced atherosclerosis of the coronary arteries, manifested by cardiomegaly and symptoms of chronic heart failure (CHF) [1-6]. In the most General sense, it is understood as dilated cardiomyopathy (DCMP) syndrome in patients with coronary heart disease (CHD) [1].

From the literature data [4,7] it is known that patients with ICMP are about 5 - 8% of the total number of patients suffering from clinically expressed forms of CHD. In the classification of WHO (1995) [8] ICMP is included in the group of secondary (specific) cardiomyopathies [4,8]. According to modern classifications [9,10], ICMP is not considered as the cardiomyopathy and is referred to CHD.

Available information on the morphology of the ICMP are mainly of a descriptive nature. At the present stage of development of medical science, this is clearly not enough for an accurate and objective assessment of the observed phenomena, as well as the establishment of possible patterns of morphogenesis of pathological changes in the heart muscle in ICMP. It becomes necessary to widely use objective quantitative research methods, in particular morphometric [11-13].

The use of morphometric methods to study the morphofunctional state of the heart is relevant, since it is believed that morphometric methods of research meet the modern requirements of evidence-based medicine [14,15] and allow to objectify the results and conclusions, since the final values of the parameters under study are quantitative and easy enough to be statistically analyzed [11,16].

However, data on the morphometry of the heart in this pathology are quite rare [6,17,18], which necessitates further research in this direction.

Aim of the Study

The aim of this work was to study changes of the myocardium in ICMP with morphometric method of research.

Materials and Methods

It is known that a quantitative morphologic characteristic of changes of each organ in the case of its any pathology must start from a definite „reference point" which is defined by the concept of a „norm" [19].

Therefore, at the research beginning the results of study of cardiac muscle of 22 persons (12 men and 10 women) in the age from 48 to 82 years who not have a concomitant cardiac pathology and died of non-cardiac causes were analyzed (group I). The myocardial parameters, which were received in this group, were taken as relative norm (RN).

Group II included 35 patients with ICMP (20 male and 15 female) aged 58 to 77 years who died from this disease. The final diagnoses in both groups of cases were verified at autopsy.

Microscopy and micromorphometry of the myocardium are carried out according to the proposed for this purpose own algorithm [20,21].

Myocardium slices from various departments of the left ventricle were filled in paraffin, cuts were painted by hematoxylin and eoziny. Respective objects were studied in ten different fields of microscope, with necessary magnifications with the help of an ocular micrometer, the point count method was also used [11,13,16]. Such parameters as zone of pericapillary diffusion (ZPD), Kernogan index (KI), stromal-parenchymatous ratio (SPR), rate of interstitial edema (RIE) were calculated. Karyometry and cytometry of cardiomyocytes (CMC's) were performed, the specific volumes of hypertrophied CMC's (SVHC), of atrophied ones (SVAC), and - by the method of polarization microscopy - the specific volume of dystrophic ones (SVDC) were determined.

The above-named parameters describe a condition of three structural components of myocardium: of microvasculature (ZPD and KI), intercellular matrix (SPR and RIE), and parenchyma (SVHC, SVAC and SVDC).

The obtained quantitative results were processed statistically (computer program „Statistica 6.0") with the level of significance of differences of 95% and more ($p \leq 0.05$).

Results

The data obtained during the study are presented in table 1.

Indicators	Microvasculature		Intercellular matrix		Cardiomyocytes		
Groups	ZPD	KI	SPR	RIE	SVHC	SVAC	SVDC
I	111.3 ± 17.9	1.22 ± 0.1	8.1 ± 5.0	7.1 ± 4.6	10.2 ± 5.0	4.8 ± 3.6	2.2 ± 2.6
II	277.2 ± 68.3*	1.71 ± 0.18*	60.2 ± 4.9*	62.5 ± 5.1*	23.6 ± 4.2*	38.9 ± 5.1*	28.1 ± 4.4*

Table 1: *Microscopic changes of the myocardium at ICMP.*

*Note: *- statistically significant difference with group I.*

Discussion

The analysis of the obtained results shows that in case of ICMP in a myocardium statistically significant differences with RN in all studied morphometric parameters are found. The noted pathological shifts in the morphometric parameters of the myocardium, reflecting the deep tissue changes in the heart muscle dystrophic-degenerative, atrophic, sclerotic, as well as compensatory-adaptive nature are briefly summarized as follows.

First of all, significant changes occur in the quantitative characteristics of the relationship of the parenchyma of the myocardium and the metabolic level of microvasculature, which clearly show a statistically significant and very sharply increasing in comparison with the RN the magnitude of the ZPD and KI (growth is respectively 149.1% and 40.2%). These findings indicate deep microcirculation disorders in the myocardium in ICMP.

With these hemodynamic changes are closely related to the progression of the interstitial edema of the myocardium and increase the severity of myofibrosis (growth of indicators RIE and SPR reaches respectively 780.3% and 643.2%). Both of these pathological processes, unfolding in the intercellular matrix of the heart muscle, lead to the separation of the nutritive blood capillaries and CMC, which seriously upsets the trophic of the latter and leads to their severe damage [22-24].

Discovered that the number of atrophied cardiomyocytes increases dramatically, (growth of indicator SVAC is 633.3%). At the same time, the process of dystrophic-degenerative changes in CMC is rapidly progressing - the value of SVDC increases by more than an order of magnitude. These processes are a standard sign of progredient myocardial dysfunction [22,24,25].

To a much lesser extent, the number of hypertrophied CMC increases, which reflects the presence of some compensatory response of the myocardium with the appearance of its injuries associated with the development of ICMP.

Conclusion

The morphometric study of myocardium in ICMP reveals statistically significant differences of all quantitative indicators from RN, which reflects the deep dystrophic-degenerative, sclerotic and to a much lesser extent compensatory-adaptive structural changes occurring in the myocardium during the morphogenesis of this disease.

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