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Characteristics Of Pathomorphological Changes In The Heart In Cases Of Sudden Cardiac Death

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Resume: in the study, the morphometric changes of the heart of 100 people who died in 2018-2020 in the age range of 30-70 years who were observed cases of sudden cardiac death were studied macroscopically and microscopically. Atherosclerotic changes in coronary vessels, age-related changes in ischemia in sympathetic nerve bundles and myocardium, ventricular fibrillation and asystole, myocarditis, dilated and hypertrophic cardiomyopathies, pulmonary hypertension were studied in autopsy examinations of patients with sudden cardiac death. .

Keywords: cases of sudden cardiac death, autopsy, coronary atherosclerosis, ventricular fibrillation, asystole, myocarditis, dilated and hypertrophic cardiomyopathies, pulmonary hypertension, denervation, World Health Organization (WHO), chronic ischemic heart disease (CIHD); acute ischemic heart disease (AIHD)

Relevance: cases of sudden cardiac death (sudden coronary death) is an acute hemodynamic condition caused by the cessation of the heart, a complete cessation of the myocardial pumping function, or effective blood circulation while maintaining the continuity of the electrical and mechanical activity of the heart. It's a non-existent state.

Currently, cases of sudden cardiac death are not determined by the expression of atherosclerosis of the coronary vessels, the presence of their acute thrombosis and structural damage to the heart muscle [1,2,3]. Cardiac arrest in cases of sudden cardiac death is directly related to ventricular fibrillation and their asystole, which appear in conditions of unstable electrical conduction of the heart [4].

WHO experts say that cases of sudden cardiac death occur within 1-6 hours after the first symptoms of a heart attack appear. It averages 46 cases per 100,000 population per year among men and -8 per 100,000 per year among women, with a male/female ratio of 6: 1. In cases of sudden cardiac death, the causes of death are: CHD - 43%, CHD - 37%, cardiomyopathies - 18%, other pathologies - 2% [2,5].

Cases of sudden cardiac deathdevelopment options: 1) Coronary sudden cardiac deaths and 2) Arrhythmic sudden cardiac deaths.

Cases of sudden cardiac death account for 0,1-0,3% of all sudden deaths in newborns, 5% in children, 30% in 14-21-year-olds, and 88% in middle-aged and elderly people.

Cases of sudden cardiac deathmainly cardiovascular defects in infants, children, adolescents (prolonged QT interval, heart defects, anomalies of the thoracic aorta and coronary vessels, prolonged QT interval, Brugad conditions, myocarditis, cardiomyopathies, heart rhythm and o conduction disorders, etc. (extreme physical exertion), acute and chronic ischemic diseases of the heart, consequences of coronary artery atherosclerosis, alcohol and drug use, diabetes mellitus, adverse effects, hypodynamia, obesity in older and older people, electrolyte disorders), caused by heart rhythm conduction disorders [5,6,7,8].

Myocardial ischemia, left ventricular dysfunction, and electrical instability are the main risk factors for sudden cardiac arrest in patients with ischemic heart disease. Electrical instability of the myocardium develops with heart rhythm disturbances, which directly lead to ventricular fibrillation and asystole.

In cases of sudden cardiac deathSudden cardiac arrest is associated with the development of ventricular fibrillation in 78,9% of cases, asystole in 20,3% of cases, and electromechanical dissociation in 0,8% [8,9].

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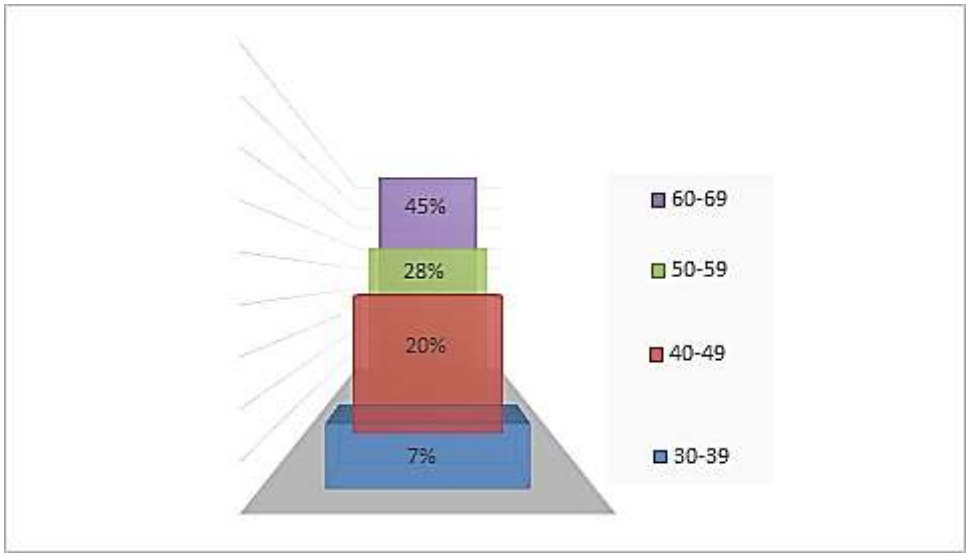
In ventricular fibrillation, endocrine gland dysfunction from extracardiac factors and cardiac - myocardial ischemia, left ventricular dysfunction and electrical instability - the main risk triad of sudden cardiac arrest in patients with ischemic heart disease.

After the age of 40, heart tissue is desympathized against the background of an increase in the number of adrenoreceptors - "age-related denervation", and the frequency of myocardial fibrillation increases as a result of this increased sympathetic denervation [10,11].

The purpose of the study: study of pathomorphological changes in the heart in cases of sudden cardiac death.

Materials and methods: 100 people aged between 30 and 70 who died in 2018-2020 with sudden cardiac death in the study (Diagram 1) and 20 control subjects of the same age group, morphometric of the heart in forensic medical histological materials and autopsy materials Changes were studied macro-microscopically. The dimensions of the heart, weight, wave deformation and dissociation of cardiomyocytes, and contracture changes were studied.

Diagram 1
The incidence of sudden cardiac death:



Research results: structural changes associated with myocardial damage are characteristic of sudden cardiac death cases, which are cardiac geometry – size, cavity shape, muscle mass and configurationleads to a change in. Cases of sudden cardiac deaththe morphological geometry of the left ventricle is important both in the normal state and in the process of remodeling. Loss of the normal elliptical appearance of the ventricles is an early sign of heart damage.

Sudden cardiac deathcompared to the control group, they were higher when compared with the normal heart. When both ventricles were histologically examined, a predominance of 2-3 degree contracture damage of cardiomyocytes was observed (diagram 2).

Diagram 2
Sudden cardiac deathComparison of heart with normal heart

GROUPS	heaviness of the heart	the length of the heart	thickness of the heart	thickness of left ventricular wall	thickness of right ventricular wall
Control group	280,4±3,2g	9,5±0,1cm	4,8±0,1mm	1,3±0,03cm	0,4±0,02cm
Research group	330±1,1g R<0.001	10,1±0,1cm R<0.001	9,4±0,1cm R<0.05	1,6±0,04cm R<0.001	0,6±0,02cm R<0.001

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Asystolic cardiac arrest was observed in extensive tissue damage (heart attacks, recurrent attacks of angina pectoris), and in minor damage - with the development of ventricular fibrillation.

Cases of sudden cardiac deathAcute manifestations of the disease were mainly observed in diffuse ischemic injury of the myocardium in the form of hyperrelaxation of cardiomyocytes, contracture degeneration of cardiomyocytes, intracellular myostolysis and fragmentastia.

Table 1
Variations in cardiac electrical conductivity

Cardiac electrical conduction	Control group	Research group
wave deformation of cardiomyocytes	57,3 ± 1,02%	44,6 ± 1,6% (R<0,001)
dissociation	64,9 ± 0,7%	57,3 ± 1,2% (R<0,001)
Amount of left ventricular contractures	64,5 ±1,7%	54,6 ±0,7% (R<0,001)
Localization of contracture injuries	Cardiomyocytes in both ventricles are grade 3	in the anterior, lateral and posterior walls of the left ventricle, mainly in the subendocardial and intramural layers of the myocardium

Cases of sudden cardiac deathsudden cardiac arrest was associated with the development of ventricular fibrillation in 78% of cases, asystole in 20% of cases, and electromechanical dissociation in 2% [4].

The diagnostic significance of the morphological criteria of acute coronary conditions in the myocardium is erythrocyte stasis in the first 4-8 hours, paralytic expansion of capillaries, diapedesis hemorrhages after 10-12 hours, leukocytes on the edge of small vessels, hemolysis, homogenization of erythrocytes in the vessels after 24 hours, infarction o "when there is a release of leukocytes with segmental nuclei along the periphery.

Cases of sudden cardiac deathin 90-96% of cases, significant atherosclerotic changes (obligatory sign of sudden cardiac death) and multiple lesions of the coronary artery (more than two branches of the artery) were found in 90-96% of cases (narrowing to 3/4) - picture)

Figure 1

Figure 1.
Cases of sudden cardiac death (male, 45 years old). Atheromatous changes in the intima and media layer of the left coronary artery, destruction, sharp narrowing of the cavity, fullness, premural thrombosis.
[paint: hematoxylin-eosin; zoom: 10x10].

Atherosclerotic changes located in the proximal part of the coronary arteries were often complicated, they were observed with signs of damage to the endothelium and the formation of completely occlusive thrombi in the vessel wall or between them (in 5-24% of cases). Among 34-82% of those who died, cardiosclerosis with the deposition of scar tissue in the conduction pathways of the heart was detected (Fig, 2-a/b).

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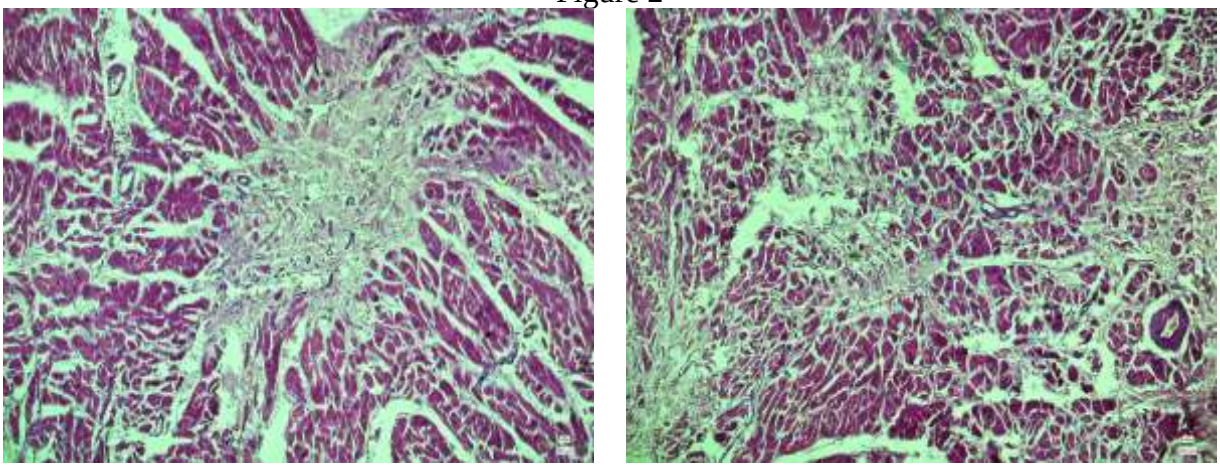
Figure 2



A *B*

Figure 2. Cases of sudden cardiac death (male, 50 years old). In the tissue of the left ventricle and interventricular septum, there are foci of extensive sclerosis, swelling of the interstitial tissue, hypertrophy of cardiomyocytes, some of them are wavy, fragmentation, perivascular sclerosis, edema. [paint: hematoxylin-eosin; zoom: 10x10].

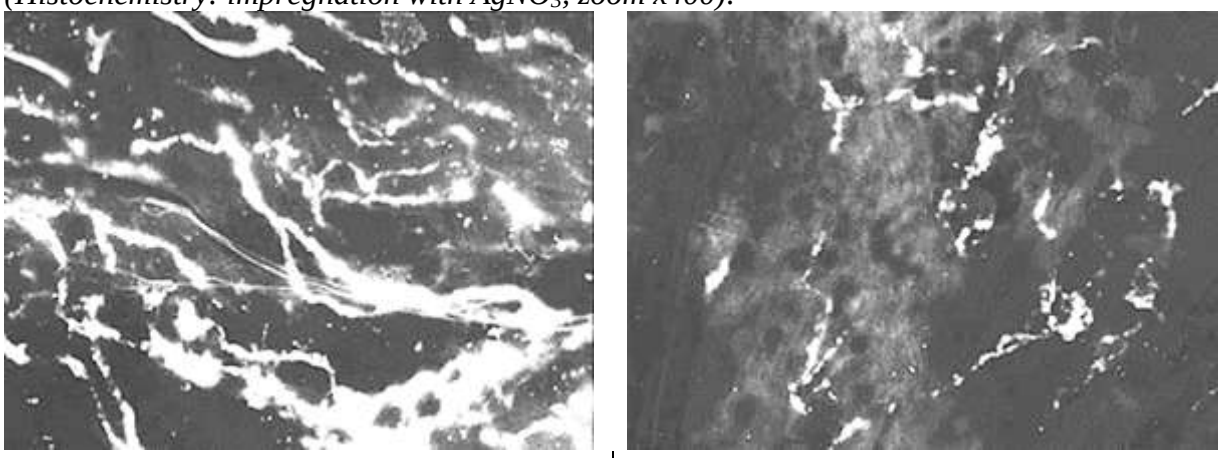
Cases of sudden cardiac deathcardiosclerosis with a large focus was often located in the interventricular membrane, which testified to the involvement of the pathological process in the conduction system.

As age increases, the importance of involutional changes in sympathetic innervation increases. The initial reactive changes of adrenergic terminals turn into destructive changes. When atherosclerosis appears, the process increases [10,11,12].

Reactive and degenerative changes in myelin fibers and receptors in the reflexogenic sinocarotid areas of the heart were observed in autopsies of people who died suddenly, culminating in cardiac fibrillation (Fig, 3-a/b).

Figure 3

Figure 3. Age-related changes in the density of left ventricular myocardium adrenergic nerve bundles
(Histochemistry: impregnation with $AgNO_3$, zoom x400):



A	*B*
Sympathetic nerve bundles in people aged 30-40	*After the age of 60, the concentration of sympathetic nerve fibers decreases*

The development of heart failure in these degenerative changes is observed in 8% of people under the age of 40, 24% under the age of 50, 30% under the age of 60, and 38% over the age of 60. The

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morphophysiological changes in cardiac tissues, the change in the concentration of sympathetic nerve bundles and the increasing denervation, were seen as the cause of increased fibrillation.

The increase of age-related changes in the nervous system causes neurodystrophic disorders of body tissues and, as a result, leads to the development of visceral pathology, sudden cardiac death. In cases of sudden cardiac death, the force of isometric contraction of myocytes increases dramatically with an increase in their adrenoreactivity [12].

Summary: Current epidemiologic data based on the above studies and literature data show that the incidence of sudden cardiac death is very high, occurring in more than 1% of the population, in more than 95% of cases. Sudden death occurs outside of medical facilities, in more than 35% of cases, when alone or in sleep.

It is recommended to take material for histological examination from the left ventricle and interventricular septum in autopsy examinations of patients with sudden cardiac death, to study the condition of sympathetic nerve bundles in combination with hematoxylin-eosin staining by histochemical methods (impregnation with silver nitrate). . Changes in the geometry of the heart, atherosclerotic changes in the coronary vessels, changes in the sympathetic nervous system and parallel age-related changes in myocardial ischemia - ventricular fibrillation and asystole, the effect on electrical instability in the thanatogenesis of sudden cardiac death. is of great importance.

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