



**MORPHOGENESIS OF SUDDEN HEART DEATHS IN THYROID GLAND
DYSFUNCTIONS**

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Abstract: The article analyzes the main causes, mechanisms, and epidemiology of sudden cardiac death (SCD). The main mechanism of SCD is associated with ventricular fibrillation, asystole, and electrical instability of the heart, and 80-90% of cases are caused by coronary heart disease. Globally, about 9 million TPPs are registered annually, the incidence of which is higher in men than in women. Age, myocardial infarction, angina pectoris, hypertension, arrhythmias, metabolic syndrome, and thyroid dysfunction, in particular hypothyroidism, are of particular importance as risk factors. It has been shown that the relationship between thyroid changes in the zone of endemic goiter and SCD and atherosclerosis has not been sufficiently studied. Autopsy reveals morphological signs characteristic of SCD - atherosclerosis of the coronary arteries, thrombosis, myocardial necrosis, cardiosclerosis, and varying degrees of left ventricular remodeling. The article emphasizes the need for in-depth study of the relationship between thyroid pathology, metabolic disorders, and SCD.

Keywords: sudden cardiac death (SCD), ischemia, arrhythmia, fibrillation, atherosclerosis, hypothyroidism, metabolic syndrome, myocardial infarction.

Relevance of the topic: Sudden cardiac death (SCD) is the most common and severe cause of death worldwide, annually claiming the lives of millions of people. The majority of cases are associated with coronary heart disease, arrhythmias, coronary atherosclerosis, and structural changes in the heart muscle. The fact that most SCD s occur before admission to the hospital, most often in the first hours of acute coronary syndrome, indicates the extreme importance of early diagnosis and prevention.

Particular attention is paid to the fact that functional disorders of the thyroid gland, in particular subclinical and manifest hypothyroidism, are becoming increasingly important as an independent factor increasing the risk of atherosclerosis, myocardial ischemia, and SCD. The insufficient study of the relationship between thyroid changes and SCD in areas of endemic goiter determines the need to continue scientific research in this area.

Therefore, an in-depth study of the pathogenesis of SCD, the role of thyroid function, its relationship with metabolic syndrome and coronary pathologies, its prevention, and improvement of morphological diagnostics are of current scientific and practical importance.

Purpose of the research. Creation and improvement of criteria for assessing the influence of dysfunctional pathomorphological, histochemical changes of the thyroid gland on the development of sudden cardiac death, the dynamics of morphological and morphometric changes.

Object of research. The study examined the morphological and morphometric changes in the tissues of the heart and thyroid gland in autopsy and forensic medical histology materials in both groups, a total of 75 samples, 50 in the study and 25 in the control, with sudden cardiac death (SCD) of 20-60 years and older in 2015-2024.

Research results:

I. Morphological changes in the heart in sudden cardiac death:

In the control group, the morphometric parameters of the heart were physiologically normal, and no pathological changes in the myocardium were observed. In cardiomyocytes, wave-like

deformation (57.3%) and dissociation (64.9%) were mild, with no signs of necrosis, myocytolysis, or caryolysis.

In the group of sudden cardiac death (SCD), a sharp increase in all the main morphometric parameters of the heart was revealed: heart weight - 330 g, left ventricular wall - 1.6 cm, right ventricular wall - 0.6 cm. This indicates the presence of hypertrophic processes.

Histologically, contracture damage of cardiomyocytes of the 2nd-3rd degree prevailed in SCD. Contractures were most often noted on the anterior, lateral, and posterior walls of the left ventricle, especially in the subendocardial zones. Widespread wave-like deformation (44.6%) and cardiomyocyte dissociation (57.3%) indicate the formation of electrical heart instability.

Microscopic examination revealed venous congestion of the myocardium, perivascular sclerosis, hypercontractile cardiomyocytes, fuchsinophilia, and cytoplasmic fragmentation. In some cases, fatty degeneration, interstitial sclerosis, and atrophy of cardiomyocytes were observed.

Arteriosclerotic changes in the coronary vessels intensified depending on age; especially in the lower branch of the left coronary artery and the right coronary artery, fibrous plaques reached the level of blocking 1/5-1/4 of the vessel lumen after 50 years of age. This is one of the main factors that increased the predisposition to cardiac ischemia.

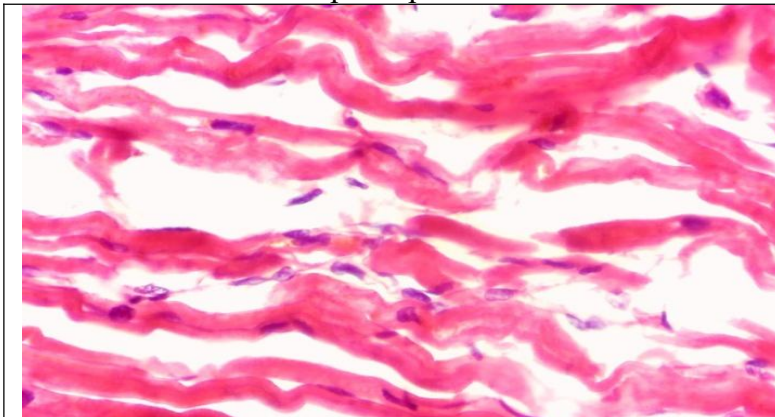


Figure 1. Contractural damage of cardiomyocytes of the 2nd-3rd degree in sudden cardiac death. Gemm-eosin staining. Magnification 4x40.

According to autopsy data, the main etiological mechanisms of SCD are rhythm disturbances, damage to the conduction system, metabolic fatigue of cardiomyocytes, and trigger factors (ischemia, stress, mechanical load). In most cases, the presence of ischemia and arrhythmogenic substrate was detected in the myocardium, even without signs of acute myocardial infarction.

The final conclusion is that macro- and microscopic changes in the heart in SCD, combined with increased electrical instability of the heart, sharply increase the risk of ventricular fibrillation.

II. Changes in the thyroid gland associated with sudden cardiac death.

In the control group, the thyroid gland had a normal morphological structure, the follicles were of the same diameter, the height of the epithelium was age-appropriate, the colloid was homogeneous, and no significant changes in the stroma were observed.

In the study group - especially among the population of the Fergana Valley, which is an endemic goiter zone - diffuse and nodular colloid goiter of varying degrees in the thyroid gland was found to be widespread. These changes are accompanied by a tendency towards hypothyroidism and negatively affect the function of certain systems, including the cardiovascular system.

In morphometric analysis:

- in nodular microfollicular goiter, the epithelium is sharply elevated, the follicles are small, colloidally vacuolated;

- in macr follicular goiter, on the contrary, the follicles are large, the epithelium is flattened, colloid is abundant, and secretory activity is reduced;
- in sclerotic goiter, the follicle diameter was large, the epithelium was low, and fibrous processes predominated.

With age, atherosclerosis, hyalinosis, and stromal sclerosis of the thyroid gland walls increased. After 40 years of age, nodular goiter sharply increased and amounted to 45% of cases.

Proliferative processes in the thyroid gland, Sanderson's ducts, cystic dilatations, interstitial sclerosis, and microcirculatory disorders reflect the mechanisms of goiter formation.

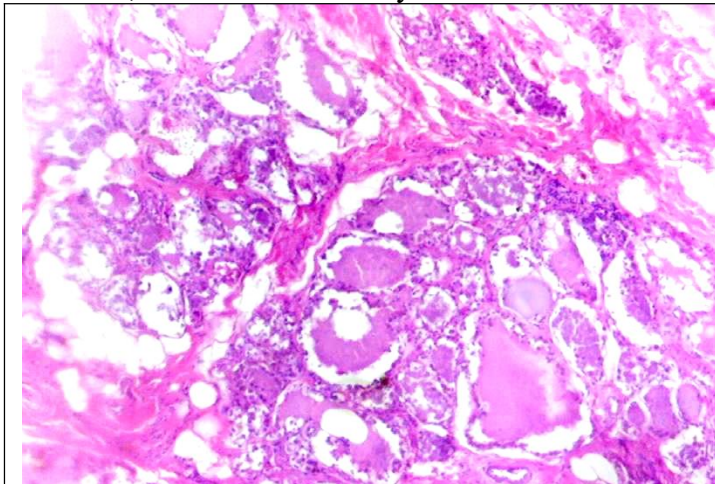


Figure 2. Appearance of the gland in the nodes in individuals aged 20-29 years: colloid saturation, vacuolization, follicles of various sizes, cubic epithelium, proliferating in some areas (Sanderson's cusps) with the formation of protrusions, swelling in the stroma, hyalinosis. Gemm. - Eosin staining, magnification 10x2.5.

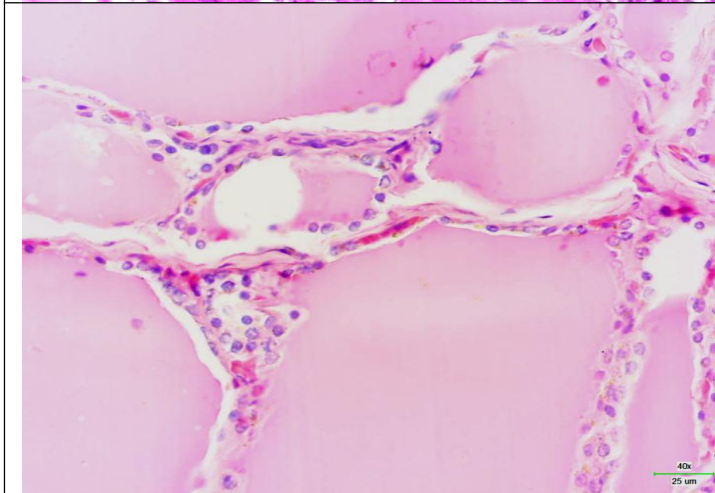


Figure-8. Appearance of the thyroid gland in the nodes of the thyroid gland in individuals aged 60 and older: colloid saturation, predominantly large follicles, cystic dilation, flattened epithelium, swelling in the stroma, hyalinosis. Gemm.-eosin stained by the eosin method, magnification 10x12.5

Associated with sudden cardiac death:

In the SCD group, an increase in the secretory activity of extraganglionic follicles in the thyroid gland, increased colloid resorption, and an increase in epithelial height were observed. However, intraganglionic activity decreased sharply. This indicates that the compensatory capabilities of the thyroid gland are limited.

Data show that a decrease in thyroid function accelerates the process of atherosclerosis, and conversely, an increase in atherosclerosis leads to the development of hypothyroidism. This inverse correlation is a factor that increases the risk of heart disease, in particular SCD.

Thus, the ischemic, arrhythmogenic changes observed in the heart in patients with SCD are closely related to morphological and functional disorders of the thyroid gland. This once again confirms the important clinical significance of thyroid diseases for heart function.



Conclusions:

1. The presence of interstitial cardiosclerosis, contracture contractions, wave-like deformation, and dissociation of cardiomyocytes in the myocardium of the heart of individuals with endemic goiter was established.
2. The prevalence of nodular macro- and microfollicular goiter in middle-aged patients with SCD, while in older patients, diffuse macro- and microfollicular goiter and morphological changes in the gland parenchyma confirmed the predominance of hypofunction.
3. A correlation was revealed between changes in age-related morphometric parameters of the thyroid gland and quantitative indicators of atherosclerotic processes in the coronary vessels, including an inverse correlation with the diameter of the follicle and the average height of the epithelium.

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