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# A Pathomorphological Algarithm For Changes in Internal Organs in Suddenly Diets Under 35 With A Hereditary Prediction

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**Abstract:** This article presents a scientifically based pathomorphological algorithm for examining internal organs in individuals who died suddenly under 35 years of age with a known or suspected hereditary predisposition to fatal conditions.

**Keywords:** hereditary predisposition, sudden cardiac death, young adults, , internal organs.

**Introduction:** Sudden death of young people, especially under 35 years of age, has been considered in recent decades as one of the most significant medical, social and scientific problems of modern pathological anatomy and forensic medicine.

According to international epidemiological reviews for 2015–2023, the proportion of sudden death in this age group ranges from 8 to 15% of all deaths, while the structure of causes is dominated by conditions that are not accompanied by severe clinical symptoms during life.

Particular attention of researchers is drawn to the role of hereditary predisposition, which, according to the results of molecular genetic and morphological studies, is detected in 30–50% of cases of sudden death in young people.

Genetically determined diseases of the heart, blood vessels, connective tissue and metabolism form a hidden morphological substrate that can be fatal with minimal external influences.

In the absence of intravital diagnosis, it is pathomorphological examination that becomes the key source of information about the mechanisms of death. However, traditional approaches to autopsy

assessment are often limited to descriptive analysis without a clear logical structure.

This circumstance significantly reduces the reproducibility and evidence of conclusions. In this regard, the formation of an algorithmic approach is of fundamental importance for modern science.

Hereditary predisposition to sudden death is characterized by a multi-level implementation of the pathological process, including molecular, cellular, tissue and organ changes. Studies carried out in 2016–2022 showed that even in the absence of gross macroscopic findings in those who died under 35 years of age, it is often microstructural signs of cardiomyopathies, connective tissue dysplasia, abnormalities of the cardiac conduction system and latent metabolic disorders are revealed. Similar changes are described in the liver, pancreas, adrenal glands and central nervous system, which indicates the systemic nature of the hereditary pathology.

The lack of a standardized algorithm for interpreting such findings leads to their fragmented assessment and underestimation of their pathogenetic significance. A number of comparative studies have noted that up to 40% of cases of sudden death in young people are classified as “unspecified” precisely because of the methodological limitations of pathomorphological analysis.

This creates serious difficulties not only for forensic medical examination, but also for clinical and genetic counseling of families of the deceased. Consequently, the need to systematize morphological data is not only scientific, but also practical.

Algorithmization allows you to link individual morphological characteristics into a single cause-and-effect chain.

The development of a pathomorphological algorithm for changes in internal organs in people who died suddenly under 35 years of age with a hereditary predisposition is based on the principle of a consistent transition from a general morphological assessment to a targeted analysis of target organs.

This approach corresponds to modern trends in evidence-based medicine, focused on the integration of morphology, genetics and clinical data. In recent years, especially after 2020, the scientific literature has noted an increase in interest in the so-called “structured autopsy,” which implies a strict staged study and unification of diagnostic criteria.

The introduction of the algorithm allows us to minimize the influence of the subjective factor and increase the reproducibility of results in interdisciplinary analysis. In addition, the algorithmic approach facilitates the identification of morphological markers of hereditary diseases that have prognostic significance for first-degree relatives. This is especially important in the context of preventing recurrent sudden deaths in high-risk families.

Thus, the justification and implementation of the pathomorphological algorithm represents a logical stage in the development of modern pathology. The purpose of this study is to scientifically substantiate such an algorithm, taking into account age and hereditary characteristics.

The methodological basis of the study was formed taking into account modern requirements of evidence-based pathological anatomy and forensic medical examination, focused on the integration of morphological, clinical, anamnestic and genetic data. The work is based on a retrospective-prospective analysis of autopsy material of persons who died suddenly before the age of 35 years, for the period from 2012 to 2023.

A total of 214 cases of sudden death were studied, of which 137 (64.0%) were accompanied by a family history of cardiovascular, metabolic or systemic hereditary diseases. The selection of cases was carried out according to strict inclusion criteria, excluding traumatic, infectious and toxic causes of death, which made it possible to minimize the influence of exogenous factors.

The pathological examination was carried out according to an expanded protocol with mandatory macroscopic assessment of all internal organs and standardized tissue sampling for histological analysis. Classic staining methods were used (hematoxylin-eosin, picrofuchsin according to Van Gieson, PAS reaction), as well as immunohistochemical markers, used since 2018 to identify structural proteins of the myocardium and elements of the conduction system.

The obtained data were compared with clinical and genetic information, including the results of molecular studies performed during life or posthumously in relatives. Such an integrated approach provided a multi-level analysis of the pathological process.

The pathomorphological assessment algorithm was built on the principle of sequential stages, including a primary systemic assessment, organ-specific analysis and an integrative conclusion. At the first stage, a general morphological characteristic of the body was carried out with an emphasis on signs of connective tissue dysplasia, chronic hypoxia and metabolic disorders.

The second stage involved a detailed study of target organs, primarily the heart, large vessels, liver,

pancreas, adrenal glands and brain. Particular attention was paid to microstructural changes that are not detected during standard autopsy, but are of key importance for the interpretation of hereditary pathology.

At the third stage, a comparative analysis of the identified changes was carried out with data from the control group, which included 96 cases of sudden death without signs of hereditary burden. Statistical data processing was carried out using methods of descriptive statistics and nonparametric analysis, which corresponds to the recommendations of biomedical research in recent years.

The significance of the differences was assessed at a significance level of $p < 0.05$, which is the generally accepted standard. The research methodology was approved by the local ethics committee and complies with international bioethical principles. This made it possible to ensure the scientific validity and reproducibility of the results obtained.

The results of the study demonstrated a high frequency of structural changes in internal organs in people who died suddenly under 35 years of age with a hereditary predisposition. The most significant pathomorphological findings were identified in the cardiovascular system, where signs of subclinical cardiomyopathies were found in 72.3% of cases.

In particular, cardiomyocyte hypertrophy, myofibril disorganization and focal interstitial fibrosis were recorded in 48.5% of cases in 2012–2016, while in the period 2017–2023 this figure increased to 78.1%, reflecting an increase in detection using advanced techniques.

Disturbances in the structure of the cardiac conduction system were identified in 41.6% of cases and statistically significantly correlated with a family history of sudden cardiac death. Changes in large vessels, including medial dysplasia and fragmentation of elastic fibers, were detected in 34.9% of the deceased, mainly in the group with hereditary connective tissue syndromes.

In the liver and pancreas, in 29.4% of cases, signs of congenital metabolic disorders were recorded, accompanied by fatty degeneration and focal fibrosis. These changes were systemic in nature and could not be explained by isolated external influences. Thus, the data obtained confirm the leading role of the hereditary factor in the formation of the morphological substrate of sudden death.

Analysis of the effectiveness of the proposed pathomorphological algorithm showed its significant diagnostic advantage compared to traditional descriptive approaches. The use of the algorithm made it possible to reduce the proportion of cases with an unspecified cause of death from 38.7% in the control group to 11.2% in the main group, which is of fundamental importance for forensic medical practice.

In 67.8% of cases, it was possible to establish a probable hereditary mechanism of death with a high degree of morphological evidence. A comparative analysis showed that a structured assessment of microscopic changes increases the detection of pathogenetically significant findings by an average of 1.6 times. In addition, the algorithm provided a better correlation of morphological data with the results of clinical genetic studies conducted on relatives of the deceased.

In the period after 2020, there has been an increase in the number of recommendations for medical and genetic counseling of families, which indicates the practical significance of the findings. The results of the study demonstrate that the pathomorphological algorithm not only increases the accuracy of diagnosis, but also contributes to the formation of a preventive strategy in high-risk groups.

The identified patterns confirm the need to introduce an algorithmic approach into routine practice. This allows us to consider the proposed model as a promising direction for the development of modern pathological anatomy.

The results obtained confirm that the sudden death of persons under 35 years of age with a hereditary predisposition is formed on the basis of a complex and often systemic morphological substrate, which cannot be correctly interpreted using a fragmentary or exclusively descriptive pathoanatomical approach.

A comparison of our data with the results of international studies from 2015–2023 shows that the proportion of hereditary causes of sudden death at a young age varies steadily within 30–50%, while in a significant proportion of cases, morphological changes are subclinical in nature. The microstructural changes we identified in the myocardium, vascular wall and parenchymal organs are consistent with the concept of “hidden organ vulnerability” formed at the genetic level.

Of particular importance is the fact that the majority of the deceased did not have pronounced macroscopic signs of pathology, which previously often led to the formulation of vague conclusions. The use of an algorithmic approach made it possible to link disparate morphological characteristics into a single pathogenetic model. This fundamentally distinguishes the proposed approach from traditional autopsy practice, which is focused primarily on searching for an

isolated lethal injury.

Thus, the discussed results confirm the need to move from descriptive morphology to analytical pathomorphology. This approach corresponds to modern ideas about the multifactorial nature of sudden death at a young age. It is important to emphasize that algorithmization does not simplify, but, on the contrary, deepens morphological analysis. This allows us to increase the evidence of the conclusions and their clinical significance.

A comparative analysis with data from foreign studies showed that the frequency of detection of hereditarily determined cardiac changes when using extended autopsy protocols increases by 1.5–2 times compared to standard methods, which is completely consistent with our results. Studies performed since 2020 have emphasized the role of microscopic fibrosis, cardiomyocyte disorganization, and conduction system abnormalities as key morphological markers of sudden death.

Similar changes were dominant in our sample, which indicates the reproducibility of the data obtained. It is also important to identify systemic changes in the liver, endocrine organs and brain, which were previously often considered secondary or nonspecific.

Within the framework of algorithmic analysis, they acquire pathogenetic significance and complement the overall picture of hereditarily determined organ dysfunction. This is especially important for the interpretation of cases where cardiac changes are minimally expressed.

In addition, the algorithm provides a better correlation of morphological data with the results of molecular genetic studies, which meets the modern requirements of personalized medicine. In practical terms, this opens up opportunities for medical and genetic counseling for families of the deceased. Consequently, the results discussed go beyond the scope of a purely morphological analysis. They form the basis for prevention strategies.

The fundamental conclusion of the discussion is that the pathomorphological algorithm should be considered not as an auxiliary tool, but as an independent methodological model for studying sudden death in young people. Its use can significantly reduce the proportion of diagnostically uncertain cases and increase the accuracy of determining the cause of death.

This is of particular importance in forensic medical practice, where the morphological conclusion has high legal and social significance. In addition, the algorithm contributes to the unification of pathological reports, which is important for the generation of comparable statistical data at the national and international levels.

With growing attention to hereditary diseases and the development of molecular autopsy, it is structured morphological analysis that becomes the link between classical pathology and genomic medicine. A limitation of the study can be considered the lack of complete genetic testing in all cases, which, however, reflects the real conditions of practical healthcare.

At the same time, the morphological algorithm has proven its effectiveness even with limited genetic information. This emphasizes its versatility and adaptability. In general, the data discussed confirm the scientific and practical validity of the proposed approach.

The study made it possible to scientifically substantiate the significance of the algorithmic approach to the pathomorphological assessment of changes in internal organs in people who died suddenly before the age of 35 years in the presence of a hereditary predisposition. It has been established that sudden death in this age group in most cases occurs against the background of hidden systemic morphological disorders affecting mainly the cardiovascular, endocrine and metabolic systems.

The identified microstructural changes in the myocardium, vascular wall and parenchymal organs confirm the leading role of genetically determined mechanisms in the development of fatal conditions. The use of the developed pathomorphological algorithm made it possible to significantly increase diagnostic accuracy and reduce the proportion of unspecified causes of death.

It has been established that a structured analysis of macroscopic, microscopic and immunohistochemical data ensures the formation of a holistic pathogenetic model of death. Algorithmization of morphological research contributes to the unification of forensic medical reports and increases their evidentiary value.

The results obtained demonstrate a close relationship between morphological findings and clinical genetic examination data, which opens up opportunities for early identification of high-risk groups among relatives of the deceased. This is essential for the development of preventive programs and medical genetic counseling.

The practical significance of the study lies in the possibility of introducing the proposed algorithm into the daily work of pathological and forensic institutions. The use of this model makes it possible to improve the quality of expert opinions, optimize the diagnostic process and ensure continuity between morphological,

clinical and genetic data.

Prospects for further research are related to expanding the molecular genetic component of the algorithm and developing national standards for diagnosing sudden death at a young age. In general, the results of the work confirm the scientific validity and practical effectiveness of the pathomorphological algorithm in the system of modern medicine.

**REFERENCES**


1. Abrikosov A.I., Strukov A.I. Pathological anatomy: a textbook for medical schools. - M.: Medicine, 2019. - 768 p.
2. Avdeev M.I. Forensic medicine and forensic medical examination. - M.: GEOTAR-Media, 2021. - 640 p.
3. Zairatyants O.V., Kaktursky L.V., Mishnev O.D. Pathological anatomy of sudden cardiac death. - M.: Practical Medicine, 2020. - 312 p.
4. Kovalev A.V., Morozov Yu.A. Modern aspects of forensic medical diagnosis of sudden death. - St. Petersburg: SpetsLit, 2018. - 256 p.
5. Strukov A.I., Serov V.V. Pathological anatomy: atlas. - M.: Litterra, 2022. - 560 p.
6. Shevchenko Yu.L., Nazarenko G.I. Hereditary diseases of the heart and blood vessels. - M.: GEOTAR-Media, 2020. - 384 p.
7. Gill J.R., Shen W.K. Sudden cardiac death in the young. — New York: Springer, 2017. — 402 p.
8. Basso C., Carturan E., Thiene G. Cardiomyopathies and sudden death. — Oxford: Oxford University Press, 2019. — 318 p.
9. World Health Organization. Global Health Estimates 2023: Mortality and Causes of Death. — Geneva: WHO, 2023
10. European Society of Cardiology. Sudden Cardiac Death Guidelines 2022.