DOI: 10.17816/PED8530-34

MORPHOLOGICAL CHARACTERISTIC AND ASSESSMENT OF CHANGES IN THE MAIN STRUCTURAL COMPONENTS OF THE HISTOHEMATOLOGICAL BARRIER OF THE THYROID TISSUE IN CASES OF THE SUDDEN CARDIAC DEATH FROM ALCOHOLIC CARDIOMYOPATHY

© O.V. Sokolova[1], O.D. Yagmurov[2], R.A. Nasyrov[1]

[1] St. Petersburg State Pediatric Medical University, Ministry of Healthcare of the Russian Federation, Russia;
[2] I.P. Pavlov First St. Petersburg State Medical University of the Ministry of Healthcare of the Russian Federation, Russia

For citation: Sokolova OV, Yagmurov OD, Nasyrov RA. Morphological characteristic and assessment of changes in the main structural components of the histohematological barrier of the thyroid tissue in cases of the sudden cardiac death from alcoholic cardiomyopathy. *Pediatrician (St. Petersburg)*. 2017;8(5):30-34. doi: 10.17816/PED8530-34

Received: 30.08.2017 Accepted: 16.10.2017

A retrospective analysis of acts of forensic medical autopsies from the archive of St. Petersburg GBUS BSME and a histological study of thyroid gland tissue in 188 cases (95 women and 93 men) were carried out with statistical processing of the obtained results for the purpose of studying and assessing the morphological changes in the main components of the histohematological barrier of thyroid gland tissue in cases of the sudden cardiac death from alcoholic cardiomyopathy. The decrease in the weight of the thyroid gland in the investigated cases and the revealed morphological signs, indicative of a decrease in the memory function of the thyroid gland were found and can be caused by the prolonged toxic effect of ethanol and its metabolites. Morphological changes in the endothelial lining of the vessels of the microcirculatory bed are caused both by the direct cytotoxic action of ethanol and its metabolites and by the action of mediators, the release of which occurs as a result of stimulation of the reactive cells, which leads to swelling, deformation and increased activity of endothelial cell membranes with the expansion of intercellular spaces and the development of increased permeability of the endothelial lining, which, in its turn, contributes to disruption of electrolyte transport and nutrients transport with changes trophism thyroid gland tissue, which is a substrate for the appearance of dystrophic and necrobiotic processes in main structural components of the histogematogenous barrier of the thyroid gland. The revealed morphological changes in thyroid gland tissue in cases of death from alcoholic cardiomyopathy have a non-specific nature and should be considered in conjunction with other visceral manifestations that are a reflection of alcohol intoxication during the chronic alcoholism.

Keywords: alcoholic cardiomyopathy; histohematological barrier of the thyroid gland.

МОРФОЛОГИЧЕСКАЯ ХАРАКТЕРИСТИКА И ОЦЕНКА ИЗМЕНЕНИЙ ОСНОВНЫХ СТРУКТУРНЫХ КОМПОНЕНТОВ ГИСТОГЕМАТИЧЕСКОГО БАРЬЕРА ТКАНИ ЩИТОВИДНОЙ ЖЕЛЕЗЫ В СЛУЧАЯХ ВНЕЗАПНОЙ СЕРДЕЧНОЙ СМЕРТИ ОТ АЛКОГОЛЬНОЙ КАРДИОМИОПАТИИ

© О.В. Соколова[1], О.Д. Ягмуров[2], Р.А. Насыров[1]

[1] ФГБОУ ВО «Санкт-Петербургский государственный педиатрический медицинский университет» Минздрава России;
[2] ФГБОУ ВО «Первый Санкт-Петербургский государственный медицинский университет им. акад. И.П. Павлова» Минздрава России

Для цитирования: Соколова О.В., Ягмуров О.Д., Насыров Р.А. Морфологическая характеристика и оценка изменений основных структурных компонентов гистогематического барьера ткани щитовидной железы в случаях внезапной сердечной смерти от алкогольной кардиомиопатии // Педиатр. – 2017. – Т. 8. – № 5. – С. 30–34. doi: 10.17816/PED8530-34

Поступила в редакцию: 30.08.2017 Принята к печати: 16.10.2017

Проведены ретроспективный анализ актов судебно-медицинских вскрытий из архива СПб ГБУЗ БСМЭ и гистологическое исследование ткани щитовидной железы в количестве 188 случаев (95 женщин и 93 мужчины) со стати-

стической обработкой полученных результатов с целью изучения и оценки морфологических изменений основных компонентов гистогематического барьера ткани щитовидной железы в случаях внезапной сердечной смерти от алкогольной кардиомиопатии. Обнаруженное в исследуемых случаях уменьшение веса щитовидной железы, а также выявленные морфологические признаки, свидетельствующие о снижении накопительной функции щитовидной железы, могут быть обусловлены длительным токсическим воздействием этанола и его метаболитов. Морфологические изменения эндотелиальной выстилки сосудов микроциркуляторного русла обусловлены как прямым цитотоксическим действием этанола и его метаболитов, так и воздействием медиаторов, выброс которых происходит вследствие раздражения реактивных клеток, что влечет за собой набухание, деформацию и повышение активности клеточных мембран эндотелия с расширением межклеточных пространств и развитием повышенной проницаемости эндотелиальной выстилки. Все это в свою очередь способствует нарушению транспорта электролитов и питательных веществ с изменениями трофики ткани щитовидной железы, которая является субстратом для возникновения дистрофических и некробиотических процессов в основных структурных компонентах гистогематического барьера щитовидной железы. Морфологические изменения ткани щитовидной железы в случаях смерти от алкогольной кардиомиопатии носят неспецифичный характер, и их следует рассматривать в совокупности с другими висцеральными проявлениями, которые выступают отражением алкогольной интоксикации при хроническом алкоголизме.

Ключевые слова: алкогольная кардиомиопатия; гистогематический барьер щитовидной железы.

The histochemical barrier (HCB) is a complex system of cellular and tissue structures that, by regulating metabolic processes between tissues and blood, ensures preservation of the composition and properties of intertissue liquid. In this manner, the HCB maintains the balance of the biological system in physiological processes and in cases of damage to tissue and organs due to exogenic or endogenic factors [8–10].

The impact of pathological factors can long remain unnoticed due to the presence in the organs of protective, compensatory, and adaptive mechanisms. The HCB has a direct and main role in the development of these mechanisms [1, 3, 4]. Undoubtedly, a striking example of the gradual development of pathological processes in vital organs can be the development of chronic alcohol intoxication due to constant intake of ethanol. The metabolites of ethanol gradually suppress the processes of energy metabolism, activating not only the lysosomal apparatus but also complex multicomponent processes of lipid oxidation. This leads directly to the development of dystrophic as well as destructive changes in the main components of the HCB of internal organs [7]. Undoubtedly, severe dystrophic and necrobiotic changes in the basic structural components of HCB entail the development of functional decompensation of vital organs.

During diagnoses, morphological identification of visceral manifestations of chronic alcohol intoxication is particularly difficult and is one of the most difficult tasks in practice for forensic experts [2, 5, 6]. However, despite the abundance of a significant amount of morphological data on toxic damage to internal organs due to ethanol and its metabolites, the structural changes in the main HCB components of thyroid tissue in chronic alcohol intoxication remain relevant and understudied. This, in turn, makes it difficult to establish diagnostic criteria and the algorithm for microscopic examination of this organ.

We evaluated the morphological changes in the main structural components of the histo-hematopoietic thyroid tissue barrier in cases of sudden cardiac death due to alcoholic cardiomyopathy.

MATERIALS AND METHODS

We collected data from 188 medicolegal autopsies (95 women [average age 45 ± 2 years] and 93 men [average age, 42 ± 2 years]) and evaluated paraffin blocks of autopsy material retrieved from the St. Petersburg Budgetary Public Health Facility Office of the Chief Medical Examiner (SPb OCME) between 2013 and 2017. According to forensic research data of the SPb OCME in all cases investigated, the immediate cause of death was acute heart failure due to alcoholic cardiomyopathy.

To conduct the histological study, paraffin sections 5 μm thick were cut and mounted on prepared glass slides. The histological preparations were stained with hematoxylin and eosin, picro-fuchsin according to the Van Gieson method, and Weigert's staining of the elastic fibers. Histological material was studied by light microscopy at 20-fold magnification (DP-2 BSWOLIMPUS, Tokyo, Japan). The obtained values of vascular-stromal and parenchymatous components were analyzed statistically using a package of applied statistical programs (SPSS Statistics 20; SPSS, Inc., Chicago, IL, USA). In statistical analysis, the values of the obtained data were presented as a mean sample and half-width of the confidence interval ($M \pm m$). The differences in the values of independent samples were analyzed with the Mann–Whitney U test. Differences were considered reliable at a significance level of $P < 0.01$.

RESULTS

The macroscopic description analysis recorded during forensic examination at autopsy demonstrated homogeneous macroscopic changes in the thyroid tissue in all cases, regardless of the age and sex of the deceased. Only in individual cases studied, namely, in female subjects, was there a nodular colloid goiter, which was represented by a palpable abnormality of up to 1.5 cm in diameter, of soft-elastic consistency, and that did not differ in color from that of the surrounding thyroid gland. Of the 188 autopsies, the size of the thyroid gland corresponded to the age norms in 70%, and the thyroid lobes were somewhat reduced in size in 30%. The thyroid tissue studied was of soft-elastic consistency with a shiny and smooth capsule, which in some places was somewhat thickened. In the sections, the distinctly plethoric tissue of the thyroid gland was of a fine-grained structure, sometimes lobed with areas of proliferation of connective tissue in the form of thin whitish interlayers.

During histological examination, the tissue structure of the thyroid gland was preserved in all samples. The distinctly plethoric and moderately edematous connective tissue capsule of the thyroid gland in the individual fields of vision was uniformly thickened by the proliferation of connective tissue without signs of inflammation. The thyroid tissue had a mainly normal follicular structure in 86% of the cases and a mixed structure in 14%. The thyroid tissue samples showed areas of micro- and macrofollicular structures with a dense, uniformly stained colloid. However, in 8% of the cases studied, the colloid was stained a light pink color and showed vacuoles. In all fields of vision, the follicular epithelium was of cubic with a uniformly colored cytoplasm; only in some areas was it somewhat flattened, and the cytoplasm was fine-grained and unevenly colored. A weakly expressed, locally moderate focal proliferation of extra- and intrafollicular epithelium with signs of formation of a mixed structure colloidal nodule in separate fields of vision was determined. The uniformly edematous stroma showed markedly sanguine veins, the lumens of which were enlarged significantly with pronounced flattening of the endothelium. In 48% of the cases with pronounced venous congestion, uneven arterial congestion was observed with some narrowing of their lumens. Endotheliocytes of arteries sharply bulged into the lumens of the vessels and were located in a stockade pattern. The nuclei of smooth muscle cells were shortened and the inner elastic membrane was convoluted. The lumens of the vessels of the microcirculatory bed showed the presence of erythrocyte stasis with the sludge phenomenon. Swollen and deformed endothelial cells of capillaries with a nonuniformly eosinophilic cytoplasm were located at a relatively equal distance from each other with mild, locally expressed perivascular edema. In 15% of the cases, individual small clusters of hemosiderophages were noted in the edematous stroma. When the test samples of thyroid tissue were stained according to the Weigert method, the course of the elastic fibers in the walls of the vessels was not changed. In all sections of thyroid tissue studied, the uniformly edematous stroma showed a mildly expressed, locally moderate diffuse proliferation of connective tissue with an increased number of fibroblasts and single small focal clusters of hemosiderophages.

The obtained correlation analysis of morphological changes in the structural components of thyroid tissue in the studied groups of men and women did not show a statistically significant difference ($P > 0.01$). The absence of significant differences enabled the assumption that the ratios of morphological changes in thyroid tissue in cases of death from alcoholic cardiomyopathy in the study groups were not correlated directly with age and sex.

Undoubtedly, macroscopic and microscopic changes in the thyroid tissue are nonspecific in nature and cannot be considered as diagnostic criteria for chronic alcohol intoxication. However, it should be noted that the weight loss of the thyroid gland found in 30% of the cases studied, as well as the revealed morphological signs indicative of decreased storage function of the thyroid gland may be due to the prolonged toxic effects of ethanol and its metabolites. A single administration of ethanol is known to increase dramatically the inclusion of iodine in the mitochondria of internal organs. With the development of chronic alcohol intoxication, the inclusion of iodine into the mitochondria is inhibited gradually. In turn, an increase in the production of total triiodothyronine and the level of thyroxin with the development of the clinical picture of hyperthyroidism is observed, as a rule, at the initial stages of alcoholism, whereas the long-term toxic effects of ethanol and its metabolites lead to decreased plasma triiodothyronine and thyroxine levels with the development of hypothyroidism. Morphological changes in the endothelial lining of the microcirculatory bed vessels found during the study are caused by the direct cytotoxic action of ethanol and its metabolites and by the action of mediators released as a result of the reactive cells' irritation, which leads to swelling, deformity, and increased activity of endothelial cell membranes with the expansion of intercellular spaces. In turn, development of increased permeability of the endothelial lining contributes to disruption of transport of electrolytes and nutrients with changes in the trophism of thyroid tissue, which serves as a substrate for the onset of dystrophic and necrobi-

otic processes in the main structural components of the HCB of the thyroid gland.

The presence of hemosiderophages in the uniformly edematous and scleroid stroma is associated with old hemorrhages due to increased vascular permeability caused by the cytotoxic effects of ethanol and its metabolites. In turn, pronounced venous congestion, as well as the presence of erythrocyte stasis with the sludge phenomenon should be considered a result of hemodynamic disorders that developed most likely due to a violation of myocardial contractility caused by alcoholic cardiomyopathy.

We demonstrated that the morphological changes in thyroid tissue in cases of death due to alcoholic cardiomyopathy are nonspecific in nature. Undoubtedly, histological changes in the thyroid gland in such cases should be considered in conjunction with other visceral manifestations that serve as a reflection of alcohol intoxication in chronic alcoholism.

REFERENCES

1. Витер В.И., Кунгурова В.В., Коротун В.В. Судебно-медицинская гистология: руководство для врачей. – Ижевск; Пермь: Экспертиза, 2011. [Viter VI, Kungurova VV, Korotun VV. Forensic histology. A guide for doctors. Izhevsk-Perm': Ekspertiza; 2011. (In Russ.)]
2. Пермяков А.В., Витер В.И. Патоморфология и танатогенез алкогольной интоксикации. – Ижевск: Экспертиза, 2002. [Permyakov AV, Viter VI. Morbid Anatomy and thanatogenesis of the alcoholic intoxication. Izhevsk: Ekspertiza; 2002. (In Russ.)]
3. Пермяков А.В., Витер В.И., Неволин Н.И. Судебно-медицинская гистология: руководство для врачей. – Ижевск; Екатеринбург: Экспертиза, 2003. [Permyakov AV, Viter VI, Nevoli NI. Forensic histology: a guide for doctors. Izhevsk-Ekaterinburg: Ekspertiza; 2003. (In Russ.)]
4. Пиголкин Ю.И., Богомолова И.Н., Богомолов Д.В., Аманмурадов А.Х. Применение морфометрии печени при дифференциальной диагностике хронических алкогольных и наркотических интоксикаций // Судебно-медицинская экспертиза. – 2002. – № 1. – С. 21–24. [Pigolkin YuI, Bogomolova IN, Bogomolov DV, Amanmuradov AH. Use of liver morphometry for differential diagnosis of chronic ethanol and narcotic poisoning. *Sudebno-medicinskaya ehkspertiza*. 2002;(1):21-24. (In Russ.)]
5. Пиголкин Ю.И., Дубровин И.А., Горностаев Д.В. Судебно-медицинская экспертиза внезапной (скоропостижной) смерти. Атлас по судебной медицине. – М.: ГЭОТАР-Медиа, 2010. – С. 275–299. [Pigolkin YuI, Dubrovin IA, Gornostaev DV. Forensic examination of sudden (unexpected) death. In: Atlas po sudebnoj medicine. Moscow: GEHOTAR-Media; 2010. P. 275-299. (In Russ.)]
6. Пиголкин Ю.И., Морозов Ю.Е., Мамедов В.К. Судебно-медицинская диагностика острой и хронической алкогольной интоксикации // Судебно-медицинская экспертиза. – 2012. – № 1. – С. 30–33. [Pigolkin YuI, Morozov YuE, Mamedov VK. Forensic medical diagnostics of acute and chronic alcohol intoxication. *Sudebno-medicinskaya ehkspertiza*. 2012;(1):30-33. (In Russ.)]
7. Пугач П.В., Круглов С.В., Карелина Н.Р., и др. Строение тимуса и брыжеечных лимфатических узлов новорожденных крыс в результате антенатального влияния этанола // Педиатр. – 2015. – Т. 6. – № 4. – С. 51–55. [Pugach PV, Kruglov SV, Karelina NR. The structure of the thymus and mesenteric lymph nodes of newborn rats as a result of the prenatal influence of ethanol. *Pediatr*. 2015;6(4):51-55. (In Russ.)]. doi: 10.17816/PED6451-55.
8. Соколова О.В. Морфологические изменения ткани миокарда при внезапной сердечной смерти от алкогольной кардиомиопатии // Судебно-медицинская экспертиза. – 2016. – № 1. – С. 3–6. [Sokolova OV. The morphological changes in the myocardial tissue after sudden cardiac death from alcoholic cardiomyopathy. *Sudebno-medicinskaya ehkspertiza*. 2016;(1):3-6. (In Russ.)]
9. Соколова О.В., Насыров Р.А. Особенности морфологических изменений ткани печени в случаях внезапной сердечной смерти от алкогольной кардиомиопатии // Педиатр. – 2017. – Т. 8. – № 1. – С. 55–60. [Sokolova OV, Nasyrov RA. Features of morphological changes of the liver's tissue in cases of sudden cardiac death because of alcoholic cardiomyopathy. *Pediatr*. 2017;8(1):55-60. (In Russ.)]. doi: 10.17816/PED8155-60.
10. Ягмуров О.Д. Гистогематический барьер как диагностический критерий при морфологических исследованиях в судебной медицине // Судебно-медицинская экспертиза. – 2013. – № 1. – С. 58–62. [Yagmurov OD. The histohematogenous barrier as a diagnostic criterion for morphological studies in forensic medicine. *Sudebno-meditsinskaya ekspertiza*. 2013;(1):58-62. (In Russ.)]

◆ Information about the authors

Olga V. Sokolova — MD, PhD, Associate Professor, Department of Pathological Anatomy with the Course of Forensic Medicine. St. Petersburg State Pediatric Medical University, St. Petersburg, Russia. E-mail: last_hope@inbox.ru.

◆ Информация об авторах

Ольга Витальевна Соколова — канд. мед. наук, доцент, кафедра патологической анатомии с курсом судебной медицины. ФГБОУ ВО «СПбГПМУ» Минздрава России, Санкт-Петербург. E-mail: last_hope@inbox.ru.

◆ Information about the authors

Orazmurad D. Yagmurov — MD, PhD, Dr Med Sci, Professor, Head, Department of Forensic Medicine and Jurisprudence. I.P. Pavlov First St Petersburg State Medical University of the Ministry of Healthcare of the Russian Federation, St. Petersburg, Russia. E-mail: oraz.yagmurov@gmail.com.

Ruslan A. Nasyrov — MD, PhD, Dr Med Sci, Professor, Head, Department of Pathological Anatomy with the Course of Forensic Medicine. St. Petersburg State Pediatric Medical University, St. Petersburg, Russia. E-mail: ran53@mail.ru.

◆ Информация об авторах

Оразмурад Джумаевич Ягмуров — д-р мед. наук, профессор, заведующий, кафедра судебной медицины и правоведения. ФГБОУ ВО «ПСПбГМУ им. И.П. Павлова» Минздрава России, Санкт-Петербург. E-mail: oraz.yagmurov@gmail.com.

Руслан Абдуллаевич Насыров — д-р мед. наук, профессор, заведующий, кафедра патологической анатомии с курсом судебной медицины. ФГБОУ ВО «СПбГПМУ» Минздрава России, Санкт-Петербург. E-mail: ran53@mail.ru.