N E W S
OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN
SERIES OF BIOLOGICAL AND MEDICAL
ISSN 2224-5308
Volume 3, Number 333 (2019), 16 – 19 **https://doi.org/10.32014/2019.2519-1629.26**

UDC 616.379-008.64

S. N. Zhumashov, K. R. Tukhtaev, Б. С. Жумашов

Khoja Akhmet Yassawi International Kazakh-Turkish University, Turkestan, Kazakhstan.
E-mail: saidulla51@mail.ru, kadir.tukhtaev@tma.uz, zhumbake@mail.ru

MORPHOLOGICAL CHANGES OF THE THYMUS DURING ACUTE INTOXICATION WITH YELLOW PHOSPHORUS

Abstract. This scientific article discusses the violation of the thymus after acute intoxication with yellow phosphorus. After 6 days, it was found that the volume of the connective tissue capsule and partitions increased in the thymus. Accumulations of mast cells are detected, the cross-sectional area decreases. One month after intoxication in the parenchyma of the lymph nodes, an increase in the plasma cells content in the cortex with a characteristic (in the form of "wheel spokes") arrangement of nuclear chromatin is visually observed. Active plasmatization of lymphocytes in these conditions is probably associated with enhanced penetration of antigens into the lymph nodes, and therefore the content of the vascular bed is particularly important. The results confirm the involvement of the immune system in the development of intoxication.

Key words: yellow phosphorus, xenobiotic substances, thymus, intoxication, microscopy.

Introduction. Relevance The production of yellow phosphorus in the Republic of Kazakhstan is one of the factors that pollute the environment with xenobiotic substances, the amount of which significantly exceeds the limit of permissible concentration in the external environment, especially at work and close to it (1.2) Intensive mining, production of phosphorus and that compounds in the cotton-growing areas of Kazakhstan are conducted on the background of ultraviolet insolation and overheating of the body, which aggravates the pathogenic effect of yellow phosphorus and its of the connections. The prolonged effect on the body of even the smallest concentrations of toxic substances contributes to the emergence of hidden, few symptomatic forms of chronic intoxication, which makes it especially necessary to search for new methods of diagnosis and treatment (3,4,5,6,7,8,9,10)

Until now, cytomorphological changes in the thymus, after acute intoxication with yellow phosphorus and its compounds, have not been adequately studied.

However, in the literature studied by us there are no data, the effect of acute phosphorus intoxication and its compounds on the organs, the thymus morphostructure.

Materials and research methods. Experimental studies were performed on 12 semi-mature outbred white male rats with an initial body weight of 120-140 g. The animals were kept in a vivarium at a normal food regime and, before the beginning of the experiment, were quarantined for 12-14 days. Weigh rats once a week. Yellow phosphorus in cotton oil was injected into rats in the stomach daily with a probe at a dose of 1.0 mg / kg body weight. After the end of the experiment, the animals were killed by decapitation under ether anesthesia. For light microscopy, samples were prepared after fixation in a 10-12% solution. formalin on phosphate buffer Paraffin sections were stained with hematoxylin and eosin.

The counting of various forms of erythrocytes was carried out on electron diffraction patterns at a magnification of 4,000 times. At least 1,000 erythrocytes were used for each term. Statistical material processing and graphing were performed on a Pentium 111 computer using the BS-Statistika program, as well as Excel-OfficeMicrosoft-Window's-98 application programs.

Results. 6 days after intoxication, the cortical substance of the thymus lobes is represented by tightly adjacent large blocks of heterochromatin, and a thin rim of poorly differentiated cytoplasm with single

mitochondria. T-lymphocytes tightly adjacent to each other, contacting their plasmolemmas. Sometimes, plasma cells are found among them, a typical feature of which are numerous narrow, concentrically located tanks of the granular endoplasmic reticulum.

Normally, plasma cells do not occur in the thymus, and the identified symptom indicates a violation of the permeability of the hematotomus barrier, which is known to include endothelial cells of the blood capillary wall, their continuous basement membrane, perivascular space, epithelioreticulocyte basement membrane and cytoplasm of the cell and the cytoplasm . cells are characterized by elongated nuclei with scalloped contours, containing predominantly heterochromatin. In their cytoplasm the Golgi complex and the endoplasmic reticulum are moderately developed.

However, especially in the medulla of the thymus lobules, epithelial cells of the stroma are found with a very well developed Golgi complex, which is located in the pernuclear zone and is represented by several dictyosomes, lysosomes and a multitude of vesicles. In such cells there are large, expanded tanks of a granular endoplasmic reticulum with flaky content in the lumen, vacuoles specific for reticuloepitheliocytes are found.

Such uviform vacuoles are characteristic of secretory epithelioreticulocytes, in which hormone-like factors – thymosin, thymopoietin and thymulin – were detected using monoclonal antibodies . This type of stromal cells is characterized by the presence of a large nucleus with diffuse chromatin and 1-2 large nucleoli, represented predominantly by the granular component.

When studying the microvasculature vessels, blood capillaries with altered endothelium were detected. The surface of endotheliocytes, facing the capillary lumen, contains numerous outgrowths and invaginations, and thinning areas are found. There are few organelles in the cytoplasm, micropinocytosis vesicles are visible. The basement membrane in the wall of such capillaries is unstructured, characterized by low electron density. These ultrastructural features suggest an increase in permeability of the blood-brain barrier. Often there are closed capillaries with a nucleating part of the endotheliocyte eminating into the lumen. Pinocytotic vesicles are numerous in the cytoplasm of endothelial cells.

Thus, the ultrastructure of thymus lymphocytes and reticuloepithelial cells at this time of the study is not characterized by gross pathology and the most noticeable change is the presence of plasma cells in the organ parenchyma due to a violation of the permeability of the hematothymus barrier.

The causes and nature of changes in immunocompetent organs in conditions of intoxication are multifaceted. A number of changes are undoubtedly due to the direct alternative effects of intoxication factors (stress, hypoxia, toxemia, etc.) on parenchymal and stromal elements. In addition, in these experimental conditions, the stress of functioning should take place and, accordingly, more intensive wear of immunocompetent cells and components of the stroma of the organs due to the appearance in the body of a significant amount of substances with antigenic and autoantigenic properties.

One month after intoxication in the parenchyma of the lymph nodes, an increase in the plasma cells content in the cortical substance with a characteristic (in the form of "wheel spokes") arrangement of nuclear chromatin, well developed, tightly fitting tanks of granular endoplasmic reticulum, large mitochondria of a rounded or slightly elongated shape is visually observed. with parallel cristae. Active plasmatization of lymphocytes in these conditions is probably associated with enhanced penetration of antigens into the lymph nodes, and therefore the content of the vascular bed is particularly important.

The vessels of the microvasculature look as spasmed; the cells forming their wall show signs of dystrophic changes. The lumen of arterioles appears to be sharply constricted, the endothelial cells protruding into it form a characteristic “jagged” structure. The nuclei of some endotheliocytes show signs of pycnosis; vacuolation of the cytoplasm of individual smooth muscle cells is found. The elastic membrane is sharply winding. In the blood capillaries, vacuolar degeneration of endotheliocytes, sometimes pycnosis of the nuclei, and destruction of the basement membrane is also noted.

The above changes can, in all likelihood, be regarded as evidence of the inclusion of an autoimmune process intoxication in the pathogenesis.

A month later, the cortical substance of the thymus lobules is represented by clusters of lymphocytes in loops formed by the reticuloepithelial stroma. Lymphocytes are characterized by a round heterochromatic nucleus and a thin rim of cytoplasm; In some thymic lymphocytes, changes in the form of perinuclear cysts expansion and signs of apoptosis are found.

The ultrastructure of reticuloepithelial cells is distinguished by polymorphism. Among them are the "light" and "dark" cells, which differ from each other in the electronic density of hyaloplasm; reticuloepithelial cells with signs of destruction and the formation of apoptotic bodies and cell breakdown are found. Along with this many thymus reticuloepitheliocytes are characterized by the presence of a well-developed granular endoplasmic reticulum in the cytoplasm, a large nucleus with a granulated nucleolus.

There are spasmodic capillaries with moderate signs of dystrophy endotheliocytes and destruction of the basement membrane. The reticuloepithelial cells located next to such capillaries showing signs of vacuolization. Reticuloepithelial cells with signs of destruction and apoptosis are detected.

It seems that in the thymus, as in other organs studied under the conditions of this pathology, destructive changes are most pronounced in the parenchymal and stromal elements of the organ, which are located in the immediate vicinity and the walls of the blood capillaries. Taking into account the presence of toxins in plasma intoxication, it can be assumed that these changes are manifestations of a direct cytotoxic damaging effect.

After 6 days in the thymus there is an increase in the volume of the connective tissue capsule and partitions, accumulations of mast cells are found, the cross-sectional area of the thymus and the area of the cortex of its lobules are reduced, i.e. there are changes that essentially reflect the accidental involution of the thymus under intoxication conditions, which is a mandatory component of the onset and development of this pathology.

The results confirm the involvement of the immune system in the development of intoxication. It can be assumed that there are several options for its involvement in the process or a combination of options, namely:

– primary alternative changes in the organs of immune protection of a polyetiological nature, aggravating the course of the main process and participating in the formation of vicious circles;

– stress response due to autoimmune process;

– stress response due to antibacterial immunity in concomitant infectious process.

Thus, in the conditions studied, there is a combination of the primary damaging effects on the immunocompetent organs and the development of a stress response in them.

Submicroscopic changes found in immunocompetent organs in the intermediate and late periods of intoxication are multidirectional in nature and cannot be interpreted unambiguously: in all likelihood, a combination of changes takes place in these circumstances;

– direct damaging effects on parenchymal and stromal elements, factors of developing intoxication (hypoxia stress, toxemia, etc.);

– stress of functioning and accelerated wear of immunocompetent cells under conditions of increased requirements to the organs of immune protection that occur during the development of intoxication.

However, in spite of the presence of both reactive and destructive changes in the organs studied, and in some cases signs of programmed cell death, the infrastructure of the lymph nodes and the thymus seems to be sufficiently safe to be able to realize the immune response. These circumstances dictate the need for a rational correction of the immune status of the body in conditions of intoxication.

С. Н. Жумашов, Қ. Р. Тұқтаев, Б. С. Жумашов

Қ. А. Ясауи атындағы Халықаралық қазақ-түрік университеті, Түркістан, Қазақстан

САРЫ ФОСФОРМЕН ЖЕДЕЛ УЛАНТЫРҒАНДА ТИМУСТЫҢ МОРФОЛОГИЯЛЫҚ ӨЗГЕРІСТЕРІ

Аннотация. Тимустың сары фосформен уланғандан соң интоксикациялық өзгерістер болады. 6 тәуліктен соң тимуста дәнекер тіндер қабығы және тосындардың көлемі үлкейеді. Базал жасушалар саны көбейеді. Интоксикациядан кейін бір айдан соң лимфатикалық тамырлардың паренхимасында плазмациттардың көбейюі байқалады. Лимфоциттардың белсенді плазматизациясы мүмкін, антигендардың лимфатикалық түйіндердің ішіне кіруіне байланысты болып табылды. Алынған нәтижелер иммунитеттік жүйенің интоксикация процессінде қатысуіні дәлелдейді.

Түйін сөздер: сары фосфор, ксенобиотикалық заттар, тимус, интоксикация, микроскопия.

С. Н. Жумашов, К. Р. Тухтаев, Б. С. Жумашов

Международный казахско-турецкий университет им. Х. А. Ясави, Туркестан, Казахстан

МОРФОЛОГИЧЕСКИЕ ИЗМЕНЕНИЯ ТИМУСА ПРИ ОСТРОЙ ИНТОКСИКАЦИИ ЖЕЛТЫМ ФОСФОРОМ

Аннотация. В этой научной статье рассматриваются нарушения тимуса после острой интоксикации желтым фосфором. Через 6 суток выяснено, что в тимусе увеличился объём соединительнотканной капсулы и перегородок. Обнаруживаются скопления тучных клеток, уменьшается площадь поперечного сечения. Через месяц после интоксикации в паренхиме лимфатических узлов визуально отмечается увеличение содержания плазмоцитов в корковом веществе с характерным (в виде «спиц колеса») расположением ядерного хроматина. Активная плазматизация лимфоцитов в данных условиях связана, вероятно, с усиленным проникновением антигенов в лимфатические узлы, в связи с чем особенно важным представляется содержание сосудистого русла. Полученные результаты подтверждают участие иммунной системы в развитии интоксикации.

Ключевые слова: желтый фосфор, ксенобиотические вещества, тимус, интоксикация, микроскопия.

Information about authors:

Zhumashov Saidulla Nurakhovich, M.D, Professor Professor of the Department of human morphology and physiology of the Khoja Ahmet Yasawi Kazakh-Turkish University, Turkestan, Kazakhstan; saidulla51@mail.ru;

Tukhtaev Kodir Rakhimovich, doctor of medical sciences, professor of the department of histology, Tashkent Medical Academy, Tashkent, Uzbekistan; kadir.tukhtaev@tma.uz; https://orcid.org/0000-0003-2519-1387

Zhumashov Baktbek Saydullaevich, Ph.D., Acting Associate Professor, Department of Surgical Diseases, Shymkent Medical Institute, Kazakhstan; zhumbake@mail.ru; https://orcid.org/0000-0002-5212-1985

REFERENCES

[1] Kozlovsky V.A. Occupational hygiene in the modern production of phosphorus: Aftoret. dis. ... doc. med. of science. M., 1985. 35 p.

[2] Kozlovsky V.A., Dardik A.G., Nadyrova G.M. etc. Hygienic efficiency of health measures in the furnace shops of phosphorus production // Occupational health and provatology in the production of phosphorus and its inorganic compounds. Alma-Ata, 1991. P. 16-25.

[3] Beloskurskaya G.I., Berdykhodzhin M.T., Aitbembbetov B.N. On the issue of the clinic of professional chronic phosphorus intoxication // Occupational hygiene and professional slaughter and van and nd. 1983. N 3. P. 19.

[4] Beloskurskaya G.I., Balmakhaeva R.M., Sabyrbaeva Kh.S., Yusupova T.Yu. To the question of the pathological aspects of chronic, occupational, phosphorus intoxication. Chimkent, 1985. P. 291-292.

[5] Beloskurskaya G.I., Berdhodzhin M.T., Aitbembebetov B.N. and others. Clinic, diagnostics and examination of working capacity in case of chronic, professional phosphorus intoxication // Methodical instructions. Alma-Ata, 1980. 17 p.

[6] Dauletbakova M.I., Ormanov N.ZH., Berdyhodzhin M.T. and others. Chronic intoxication with phosphorus compounds (issues of pathogenesis, clinic of diagnostics and examination of working capacity) // Methodical recommendations. Alma-Ata, 1991. 22 p. DM

[7] Atchabarov B.A., Beloskurskaya G.I., Aitbembetov B.N., Berdyhodzhin M.T. Professional diseases caused by exposure to phosphorus and its compounds // Guidelines for occupational diseases. M.: Medicine, 1983. Vol. 1. P. 290-295.

[8] Bobova L.P., Kuznetsov S.L., V.P. Histophysiology of the blood and hematopoietic organs and immunoimmunogenesis. M.: New Wave, 2003.

[9] Zhumashov S.N., Tastemirova B.T., Zhumashov B.S. Morphological characteristics of tissue structures and vessels of the microcirculatory bed of the stomach during intoxication with pesticides Omite-57, Neoron, Sumi-Alfa against the background of alloxan diabetes // News of NAS RK. Medical series. 2017. N 6. P. 68-72.

[10] Zhumashov S.N., Tastemirova B.T., Umarova A.N. Histological features of the tissue elements of the small intestine in acute priming with Omic-579 pesticides, Neoron, Sumi-Alfa on alloxan diabetes // News of NAS RK. Medical series. 2017. N 6. P. 93-97.

[11] Davletov K.K., McKee M., Myrkassimova A., Khozhamkul R., Iskakova B., Arzykulov Z.A. Addressing the growing burden of NCDS: return to Alma-Ata and primary healthcare approach // News of the National academy of sciences of the Republic of Kazakhstan. Series of biological and medical. ISSN 2224-5308. 2019. Vol. 1, N 331. P. 5-10. https://doi.org/10.32014/2019.2519-1629.1