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Microscopic structure of the rat spleen during the introduction of a genetically modified product

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Abstract: New facts have been established about the reaction patterns of peripheral immune organ (spleen); we have shown for the first time an increase in the number of medium-sized lymphocytes and blast cell forms in the reproduction centers of lymphoid nodules of the rat spleen with the introduction of a genetically modified product. Changes in intraorgan vessels under the influence of a genetically modified product were revealed.

Keywords: Spleen, lymphoid nodes, lymphoid follicles, genetically modified product.

1. Introduction

1.1. The Relevance of the Problem.

Currently, most of the food consumed is either genetically modified food, or food containing food components produced using gene modification technology [6,9]. Genetically modified products are completely identical to their natural samples in their basic characteristics, such as color, smell and appearance. All over the world, many different products have been regenerated by genetic modification and have received a patent for use as feed for humans and animals from the institutes of health of many countries. Corn, soybeans, tomatoes, potatoes, rice, wheat are the leading agricultural products derived from GM species. The most popular products are soy, cotton, corn and rapeseed, and among them this process is applied mainly to soy. In a study conducted in our country, as a result of verification, food products and local seeds did not contain genetically modified organisms, whereas all imported soybean and corn seeds were transgenic [1,2,3,9]. As a result, it was revealed for the first time that GM soy has an embryotoxic, mutagenic, gonadotoxic effect on the first and second generations of non-white rats; it was proved that they cause morphological changes in the liver and spleen; the influence of a biomedical assessment of damage to the body by GM products of a biological marker, the immunotropic index, was proved; to determine the toxic quality, it was recommended to conduct a biotest using Samara biomarkers-infusion polycultures [4,5].

Unfortunately, this problem, which is of undoubted scientific, applied and fundamental interest, still remains unresolved. The results obtained show that the risk

of GM products increases both for humans and for the environment, but the studies conducted are incomplete, and comprehensive studies have not been conducted from a morphological point of view. In this regard, conducting new research in this direction meets modern requirements [7,8].

2. The Results of the Study.

The histological structure of the rat spleen with the introduction of GM soy showed that the LN of 3-month-old rats can be visually divided into primary and secondary, the percentage of which is 31% and 69%, respectively. The formed germinative centers are determined in the secondary LN. The cells are large, often merge. The LN of the white pulp of the rat spleen mainly has a rounded, oval and elongated shape.

In most cases, the LN zones are clearly distinguishable. The study of the cellular composition of the white pulp of 3-month-old baby rats showed the following picture: the width of the germinal center averaged 90.3 ± 0.6 microns. The width of the periarterial zone was equal on average to 53.5 ± 0.2 microns.

The width of the mantle zone averages 93.8 ± 2.2 microns. The width of the marginal zone is on average 67.3 ± 1.2 microns.

The thickness of the capsule at the gate was on average 10.0 ± 0.2 , at the front end on average this value was equal to 20.7 ± 0.2 microns, at the rear end it averaged 18.2 ± 1.9 . The diameter of the trabecula in the proximal part was on average 16.8 ± 1.1 , and in the distal part on average 13.4 ± 1.7 microns. The depth of the trabecula averaged 33.5 ± 1.2 microns.

In histopreparations of the spleen of 3-month-old intact rats, a clearer separation of the organ parenchyma into red and white pulp was observed. The relative area of the white pulp was on average $22.3 \pm 0.12\%$. The relative area of the red pulp averaged $77.7 \pm 0.3\%$.

The number of lymphoid follicles (LF) without breeding centers averaged 3.1 ± 0.12 , and with a breeding center averaged 9.0. The size of the LF averaged 98.1 ± 3.2 microns. The distance between the marginal zone of the LF was on average 24.3 ± 0.6 microns, the distance between the germinative centers was on average 79.9 ± 1.6 microns.

The study of the trabecular vessels in the proximal part showed that the thickness of the venous wall averaged 6.4 ± 0.02 microns, the inner diameter of the vein was on average 7.8 ± 0.4 microns, the thickness of the artery wall was on average 7.2 ± 0.2 , the inner diameter of the artery averaged 8.24 ± 0.06 .

The trabecular vessel in the distal part had the following values: the thickness of the venous wall was on average 4.9, the inner diameter of the vein was on average 7.6 microns, the thickness of the arterial wall was on average 6.1, the inner diameter of the artery was on average 7.0. The wall thickness of the venule of the pulpary

vessel was on average 3.8 microns, the inner diameter of the venule was on average 6.2, the wall thickness of the arteriole was on average 4.6, and its inner diameter was on average 6.2 microns. The wall thickness of the lymphoid follicle venule is on average 2.4, while the inner diameter is on average 6.1. The wall thickness of the arteriole of the lymphoid follicle averaged 3.1, and the inner diameter of the LF arteriole was 4.4 microns on average.

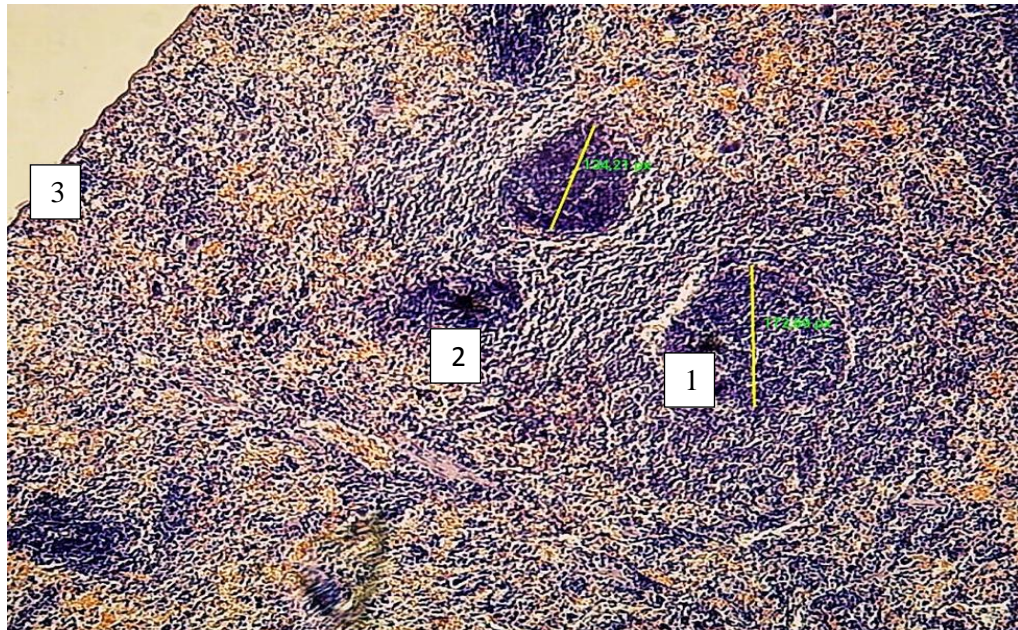


Fig.1. The spleen of a 3-month-old rat. Coloring GE. 1- LF with germinative center, 2-LF without germinative center, 3-capsule

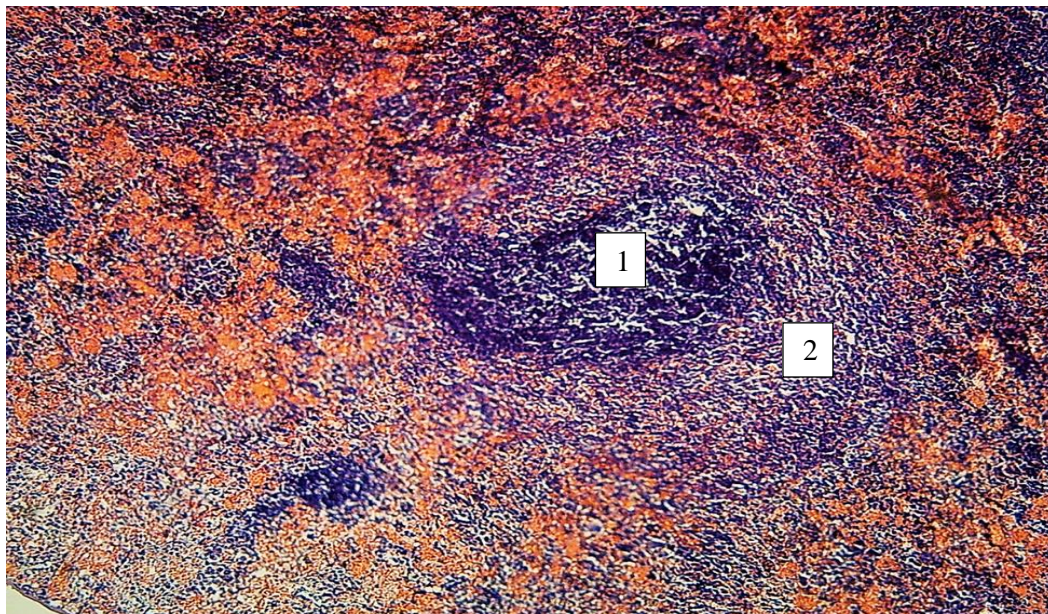


Fig.2. The spleen of a 6-month-old rat. Coloring GE. 1- LF with a germinative center, 2-LF without a germinative center

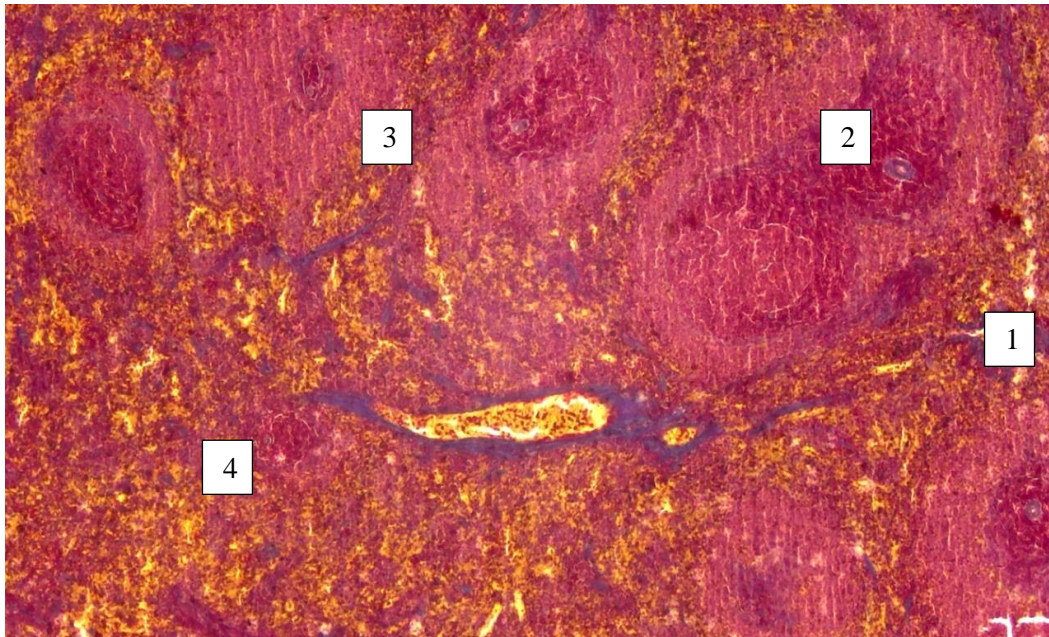


Fig.3. The spleen of a 6-month-old rat. Masson coloring. 1- trabecular vessel 2- LF 3- red pulp 4- white pulp

The study of the cellular composition of the white pulp of 6-month-old baby rats showed the following picture: the width of the germinal center averaged 95.5 ± 0.4 microns. The width of the periarterial zone was equal to an average of 54.6 ± 0.3 microns.

The width of the mantle zone averages 97.0 ± 1.2 microns. The width of the marginal zone was on average 70.1 ± 0.2 microns.

The thickness of the capsule at the gate was on average 10.7 ± 0.3 , at the anterior end on average this value was equal to 22.4 microns, at the posterior end it averaged 19.8. The diameter of the trabecula in the proximal part averaged 17.3, and in the distal part it was on average 11.2 microns. The depth of the trabecula averaged 37.8 microns.

The relative area of the white pulp fluctuated by an average of $20.7 \pm 0.1\%$. The relative area of the red pulp averaged $79.3 \pm 0.4\%$.

The number of lymphoid follicles (LF) without breeding centers averaged 4.3, and with a breeding center averaged 11.1. The LF dimensions averaged 112.0 microns. The distance between the marginal zone of the LF was on average 24.3 microns, the distance between the germinal centers was on average 82.9 microns.

The study of the trabecular vessels in the proximal part showed that the thickness of the venous wall averaged 6.7 microns, the inner diameter of the vein was on average 8.02 microns, the thickness of the artery wall was on average 7.8, the inner diameter of the artery averaged 8.4. The trabecular vessel in the distal part had the following values: the thickness of the venous wall was on average 5.6, the inner diameter of the vein was on average 7.8 microns, the thickness of the arterial wall was on average 7.01, the inner diameter of the artery was on average 8.1. The wall

thickness of the venule of the pulpar vessel was on average 4.2 microns, the inner diameter of the venule was on average 6.7, the wall thickness of the arteriole was on average 4.7, and its inner diameter was on average 6.5 microns. The wall thickness of the lymphoid follicle venule is on average 2.5, the inner diameter is on average 6.3. The wall thickness of the lymphoid follicle arteriole was on average 3.2, and the inner diameter of the LF arteriole was on average 4.9 microns.

The study of the cellular composition of the white pulp of 9-month-old baby rats showed the following picture: the width of the germinal center was on average 96.9 ± 0.5 microns. The width of the periarterial zone averaged 58.2 ± 0.3 microns.

The width of the mantle zone averages 101.0 ± 1.9 microns. The width of the marginal zone was on average 74.5 ± 0.3 microns.

The thickness of the capsule at the gate was on average -11.3 ± 0.2 , at the front end on average this value was equal to 24.0 microns, at the rear end it averaged 20.1. The diameter of the trabecula in the proximal part was on average 18.8, and in the distal part on average 16.7 microns. The depth of the trabecula averaged 41.4 microns.

The relative area of the white pulp was on average $21.6 \pm 0.2\%$. The relative area of the red pulp was on average $79.4 \pm 0.2\%$.

The number of lymphoid follicles (LF) without breeding centers averaged 2.7, and with a breeding center averaged 9.3. The size of the LF was equal to an average of 130.4 microns. The distance between the marginal zone of the LF was on average 24.5 microns, the distance between the germinative centers was on average 91.9 microns.

The study of the trabecular vessels in the proximal part showed that the thickness of the venous wall averaged 7.1 microns, the inner diameter of the vein was on average 9.4 microns, the thickness of the artery wall was on average 9.1, the inner diameter of the artery was on average -9.3. The trabecular vessel in the distal part had the following values: the thickness of the venous wall was on average 6.4, the inner diameter of the vein was on average 8.5 microns, the thickness of the arterial wall was on average 7.2, the inner diameter of the artery was on average 8.5. The wall thickness of the venule of the pulp vessel averaged 4.4 microns, the inner diameter of the venule averaged 7.4, the wall thickness of the arteriole was on average 4.9, and its inner diameter was on average 6.9 microns. The wall thickness of the lymphoid follicle venule is on average 3.2, the inner diameter is on average 6.5. The wall thickness of the lymphoid follicle arteriole was on average 3.7, and the inner diameter of the LF arteriole was on average 5.3 microns.

The study of the cellular composition of the white pulp of 12-month-old baby rats showed the following picture: the width of the germinal center was on average

99.9 ± 0.4 microns. The width of the periarterial zone is on average 62.7 ± 0.1 microns.

The width of the mantle zone averages 102.8±1.4 microns. The width of the marginal zone is on average 77.8 ± 0.12 microns.

The thickness of the capsule at the gate was on average 12.1 ± 0.3, at the anterior end on average this value was equal to 24.6 microns, at the posterior end it averaged 22.3. The diameter of the trabecula in the proximal part is on average 21.1, and in the distal part it is on average 17.7 microns. The depth of the trabecula averages 44.9 microns.

The relative area of the white pulp was on average 20.1±0.2%. The relative area of the red pulp is on average 80.1 ± 0.3%.

The number of lymphoid follicles (LF) without breeding centers averaged 3.6, and with a breeding center averaged 9.3. The size of the LF was equal to an average of 137.5 microns. The distance between the marginal zone of the LF was on average 24.4 microns, the distance between the germinative centers was on average 100.3 microns.

The study of the trabecular vessels in the proximal part showed that the thickness of the venous wall averaged 7.8 microns, the inner diameter of the vein was on average 9.5 microns, the thickness of the artery wall was on average 9.1, the inner diameter of the artery was on average 9.5. The trabecular vessel in the distal part had the following values: the thickness of the venous wall was on average 6.9, the inner diameter of the vein was on average 8.6 microns, the thickness of the arterial wall was on average 7.3, the inner diameter of the artery was on average 8.6. The wall thickness of the venule of the pulpar vessel averaged 4.6 microns, the inner diameter of the venule averaged 7.6, the wall thickness of the arteriole was on average 5.3, and its inner diameter was on average 7.2 microns. The wall thickness of the lymphoid follicle venule is on average 3.3, the inner diameter is on average 6.5. The wall thickness of the lymphoid follicle arteriole was on average 4.2, and the inner diameter of the LF arteriole was on average 5.4 microns.

3. Conclusions.

Data on the regularities and features of the structural organization of the components of the lymphoid tissue of the spleen of rats in normal conditions for the comparative study of morphogenesis during the introduction of a genetically modified product into the body were obtained. New facts have been established about the reaction patterns of peripheral immune organ (spleen); we have shown for the first time an increase in the number of medium-sized lymphocytes and blast cell forms in the reproduction centers of lymphoid nodules of the rat spleen with the introduction of a genetically modified product.

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