

# MORPHOMETRIC CHANGES IN THE ENDOCRINOCYTES OF THE CORTEX AND THE MEDULLA OF THE RATS' ADRENAL GLANDS DURING THE TRANSPLANTATION OF CRYOPRESERVED PLACENTA AND AT THE ASEPTIC PERITONITIS

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## Abstract

*The aim of the research was the morphometric study of the endocrinocytes of the cortex and the medulla of the adrenal glands during the transplantation of cryopreserved placenta (CPP) and at the aseptic peritonitis (AP).*

*During the transplantation of CPP the changes of glomerular zone occurred at the expense of the increase of the endocrinocytes' number on the 7<sup>th</sup> and the 10<sup>th</sup> days. Zona fasciculata responded with the increase of secretory activity from the 3<sup>rd</sup> to the 7<sup>th</sup> day with the simultaneous intensification of synthesis during all terms of the research. Secretory activity of the medulla increased from the 7<sup>th</sup> to the 10<sup>th</sup> days, whereas the synthesis intensified on the 3<sup>rd</sup> and the 14<sup>th</sup> day of observation.*

*At the AP the number of endocrinocytes of glomerular zone varied from the 5<sup>th</sup> to the 14<sup>th</sup> day. Intensification of secretory activity of zona fasciculata lasted from the 5<sup>th</sup> to the 14<sup>th</sup> day, whereas synthesis increased on the 3<sup>rd</sup> and the 14<sup>th</sup> day of the study. The medulla reacted with the increase in a secretory activity on the 10<sup>th</sup> and the 14<sup>th</sup> days of the experiment at the intensification of synthetic activity from the 7<sup>th</sup> to the 10<sup>th</sup> day.*

**Keywords:** cryopreserved placente, aseptic peritonitis, adrenal cortex, adrenal medulla, spongiocytes, epinephrocytes, norepinephrocytes

## Introduction

The normal functioning of the organism is characterized with a cascade of adaptive reactions that provide constancy of internal environment. As a result of morphological and functional changes, structural and energy opportunities are corrected and non-specific resistance of the organism is increased [7].

Participation of the adrenal glands in the development and implementation of adaptive reactions is manifested in peculiar reorganization of the gland structure, which is reflected in its morphology [2].

It is known that in the tissue of the placenta there is a large number of biologically active substances: hematopoietic and antiproliferative compounds, hormones, their predecessors and regulators, anti-stress and anti-hypoxic regulators etc. [1, 5]. The transplantation of placenta as homeostasis regulator is determined by the presence of a number of factors that stimulate the differentiation of cellular elements via various polypeptide compounds [2, 6]. Experimental, namely morphological, findings and clinical observations allow to state that after the transplantation of the placenta fragments the endocrine organs, tissues of liver, spleen, ovaries are stimulated, trophism of the cardiovascular system is improved, tissue reparative properties are increased [1, 2]. Administered material influences target organs, stimulating their functions and increasing non-specific resistance of an organism to the negative environmental factors and stressful situations [2].

Therefore, the study of changes in the adrenal tissue after the transplantation of cryopreserved placenta and at the aseptic peritonitis is an interesting and promising issue.

**The aim** of the research was the morphometric study of the endocrinocytes of the cortex and the medulla of the adrenal glands during the transplantation of cryopreserved placenta (CPP) and at the aseptic peritonitis (AP).

**Materials and methods of the research.** Work is performed on 95 white male rats of "Vistar" line, divided into 3 groups. Group I – 5 intact animals, group II – 45 animals which were made one-time transplantation of cryopreserved placenta [8], group III - 45 animals which were infected with the acute experimental aseptic peritonitis via administering intraperitoneally of 5 mg of  $\lambda$ -carrageenan («Sigma», USA) in 1 ml of isotonic solution of NaCl per an animal [5, 8]. The withdrawal of animals from the experiment was carried out by an overdose of thiopental anesthesia on the 1<sup>st</sup>, the 2<sup>nd</sup>, the 3<sup>rd</sup>, the 5<sup>th</sup>, the 7<sup>th</sup>, the 10<sup>th</sup>, the 14<sup>th</sup>, the 21<sup>st</sup> and the 30<sup>th</sup> days. Research of the adrenal tissue was carried out according to established deadlines.

The adrenal tissue was compacted into paraffin and epoxy resin with conventional methods and was used to produce histological sections, which were stained with hematoxylin-eosin (paraffin sections) and methylene blue (half-thin sections) [3].

The measurements of the mean value of the endocrinocytes number of the unit area in the glomerular zone – corticosterocytes, the endocrinocytes in zona fasciculata – the number of light and dark spongiocytes, and the endocrinocytes of zona reticularis were made. The quantity of the medulla cells was determined by counting the number of the medulla's epinephrocytes (light) and norepinephrocytes (dark). Moreover, the mean value of the nucleocytoplasmic index of the endocrinocytes of the cortex and the medulla was determined. We used the standard area method ( $S=7018.96 \pm 15.65$ ), working with a microscope «Micromed XS-5510" with digital photomicroattachment of «Micromed» company with program TSView adapted for such researches. Mathematical analysis of the material was performed using standard methods of the variation statistics: calculation of the mean values (M), the error of the mean values (m), Student's test (t). Differences were considered significant at  $p < 0.05$  [4].

## Results of the research and their discussion.

In zona glomerulosa the number of corticosterocytes during the transplantation of CPP for all terms of the adrenal observation changed differently. The significant increase of this indicator was observed on the 3<sup>rd</sup>-10<sup>th</sup> days, with a maximum increase on the 7<sup>th</sup> day ( $p < 0.05$ ). Starting from the 14<sup>th</sup> to the 30<sup>th</sup> day, this figure didn't differ considerably from the same in the intact group.

When simulating the aseptic peritonitis, we found a considerable increase in the number of corticosterocytes already on the 3<sup>rd</sup> – the 7<sup>th</sup> day, the significance was ( $p < 0.05$ ). On the 10<sup>th</sup> – the 14<sup>th</sup> days there was an inessential decrease of this indicator when compared to the previous period of the study. On the 21<sup>st</sup> – 30<sup>th</sup> day, this figure wasn't considerably different from the same index in the intact group.

Having compared the indicators of corticosterocytes' quantity between II and III groups, we found that it was considerably higher in the group with the AP (the 3<sup>rd</sup> – the 7<sup>th</sup> days of the study).

The nucleocytoplasmic index of corticosterocytes of this zone significantly changed in the II-nd group from the 7<sup>th</sup> to the 10<sup>th</sup> day, compared to the intact group, and in the III-rd group from the 5<sup>th</sup> to the 14<sup>th</sup> day ( $p < 0.05$ ). This in turn confirms the change of the cell activity in this zone at aseptic peritonitis from the 5<sup>th</sup> to the 14<sup>th</sup> day and during the transplantation of CPP from the 7<sup>th</sup> to the 10<sup>th</sup> day.

While doing the morphometric study of zona fasciculata, compared to the intact group, it was found that during the transplantation of CPP the mean quantity of the light spongiocytes considerably increased from the 3<sup>rd</sup> to the 7<sup>th</sup> day, the significance was ( $p < 0.05$ ). The mean number of the dark spongiocytes was at a high level in all periods of observation with a maximum increase on the 10<sup>th</sup> day, the significant difference was ( $p < 0.05$ ). On the 21<sup>st</sup> and 30<sup>th</sup> day the mean number of the light and the dark spongiocytes didn't differ considerably from the data of the intact group.

At the AP, compared to intact group, a significant increase in the number of the light spongiocytes was observed from the 5<sup>th</sup> to the 14<sup>th</sup> day, with the maximum index on the 5<sup>th</sup> day ( $p < 0.05$ ). The number of the dark spongiocytes increased on the 3<sup>rd</sup>, the 10<sup>th</sup> and the 14<sup>th</sup> days of the experiment with the maximum index on the 3<sup>rd</sup> day, the significance was ( $p < 0.05$ ). On the 21<sup>st</sup> and the 30<sup>th</sup> day quantity indices didn't differ considerably from the data of the intact group.

Comparison of the II and the III groups with each other showed that the quantity of the light spongiocytes during the transplantation of CPP prevailed on the 3<sup>rd</sup> and the 7<sup>th</sup> day, and the number of the dark spongiocytes considerably increased from the 5<sup>th</sup> to the 10<sup>th</sup> day with the maximum index on the 10<sup>th</sup> day, the significance was ( $p < 0.05$ ).

Also the change in the nucleocytoplasmic index of the light and the dark spongiocytes was observed in all terms of observation.

So at the transplantation of CPP the maximum secretion of hormones in zona fasciculata took place from the 3<sup>rd</sup> to the 7<sup>th</sup> day with simultaneous increase of increased synthetic activity. And at the aseptic peritonitis secretory activity increased on the 5<sup>th</sup> – 14<sup>th</sup> days, whereas synthesis increased on the 3<sup>rd</sup> and 14<sup>th</sup> day.

The quantity of endocrinocytes of zona reticularis in group II, compared to the intact group, was significantly increased from the 3<sup>rd</sup> to the 7<sup>th</sup> day ( $p < 0.05$ ). Nucleocytoplasmic index of endocrinocytes in group II changed considerably from the 3<sup>rd</sup> to the 10<sup>th</sup> day.

At the AP, compared to the intact group, there was a slight significant increase in the number of endocrinocytes on the 7<sup>th</sup> day and decrease on the 14<sup>th</sup> day ( $p < 0.05$ ). The change of the nucleocytoplasmic index took place from the 5<sup>th</sup> to the 14<sup>th</sup> day, the significance was ( $p < 0.05$ ).

Comparison of the experimental groups with each other showed that the number of endocrinocytes of zona reticularis during the transplantation of CPP increases significantly from the 3<sup>rd</sup> to the 5<sup>th</sup> day ( $p < 0.05$ ) and insignificantly – on the 7<sup>th</sup> day ( $p > 0.05$ ). Significant reduction of endocrinocytes in the group II

compared to the group III took place on the 10<sup>th</sup> day ( $p < 0.05$ ). From the 14<sup>th</sup> to the 30<sup>th</sup> day no considerable changes in indices took place.

The study of the medulla of the experimental groups in comparison to the intact group showed that at the transplantation of CPP the mean value of the number of epinephrocytes of the medulla significantly increased on the 7<sup>th</sup> and the 10<sup>th</sup> days of observation ( $p < 0.05$ ). Whereas, the number of norepinephrocytes increased from the 3<sup>rd</sup> to the 14<sup>th</sup> day.

At the AP, compared to the intact group, the number of epinephrocytes significantly increased from the 3<sup>rd</sup> to the 5<sup>th</sup> day and from the 10<sup>th</sup> to the 14<sup>th</sup> day ( $p < 0.05$ ). The number of norepinephrocytes significantly increased on the 7<sup>th</sup> and 10<sup>th</sup> days ( $p < 0.05$ ).

Comparison of the mean number of epinephrocytes and norepinephrocytes of the experimental groups with each other showed that considerable significant increase of epinephrocytes during the transplantation of CPP occurs on the 7<sup>th</sup> day, and norepinephrocytes – from the 3<sup>rd</sup> to the 5<sup>th</sup> and on the 10<sup>th</sup> day ( $p < 0.05$ ). Whereas, during the AP the number of epinephrocytes significantly increased on the 14<sup>th</sup> day of observation and norepinephrocytes on the 7<sup>th</sup> day ( $p < 0.05$ ). On the 21<sup>st</sup> and the 30<sup>th</sup> day no considerable changes in indices took place. The change of the nucleocytoplasmic index of epinephrocytes and norepinephrocytes took place in all periods of observation.

## Conclusion

Thus, during the transplantation of CPP the changes of glomerular zone occurred at the expense of the increase of the endocrinocytes' number on the 7<sup>th</sup> and the 10<sup>th</sup> days. Zona fasciculata responded with the increase of secretory activity from the 3<sup>rd</sup> to the 7<sup>th</sup> day with the simultaneous intensification of synthesis during all terms of the research. Secretory activity of the medulla increased from the 7<sup>th</sup> to the 10<sup>th</sup> days, whereas the synthesis intensified on the 3<sup>rd</sup> and the 14<sup>th</sup> day of observation.

At the AP the number of endocrinocytes of glomerular zone varied from the 5<sup>th</sup> to the 14<sup>th</sup> day. Intensification of secretory activity of zona fasciculata lasted from the 5<sup>th</sup> to the 14<sup>th</sup> day, whereas synthesis increased on the 3<sup>rd</sup> and the 14<sup>th</sup> day of the study. The medulla reacted with the increase in a secretory activity on the 10<sup>th</sup> and the 14<sup>th</sup> days of the experiment at the intensification of synthetic activity from the 7<sup>th</sup> to the 10<sup>th</sup> day.

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