SCIENTIFIC RESEARCH: MODERN CHALLENGES AND FUTURE PROSPECTS

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MEDICAL SCIENCES

CHANGES IN THE EXPRESSION OF PEANUT AGGLUTININ (PNA) RECEPTORS ON THYMOCYTES IN THE NORMAL CONDITION AND AFTER PRENATAL ADMINISTRATION OF DEXAMETHASONE IN RATS

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Introductions: The thymus is a key organ in the immune-endocrine regulatory system, functioning both as an immune organ and an endocrine gland, performing important functions in ensuring the structural and functional maturation of immune-competent cells. Disturbances in the maturation and differentiation of the thymic main structures leading factor in the development of are a immunopathological conditions and also in the desadaptation syndrome in newborns and infants during the first year of life. Stress primarily affects the cellular component of immunity, which makes it particularly relevant to examine the impact of glucocorticoid drugs on the intrauterine development of the thymus and the postnatal formation of adaptive cellular immunity. Cortical thymocytes are especially sensitive to the induction of apoptosis due to the weak expression of anti-apoptotic factors, including the influence of glucocorticoids. In thymocytes that have received signals for further development from epithelial cells, the expression of anti-apoptotic factors is enhanced. It is notable that the migration of maturating thymocytes within the thymus is determined both by the gradient of chemokines, secreted by stromal cells, and by the presence of corresponding specific carbohydrate receptors on the surface of thymocytes, such as glyco-conjugates. On functionally immature lymphocytes, the carbohydrate residue of β -D-galactose is expressed to a greater extent, reflecting the adhesive properties of lymphocytes to the surrounding cells of microenvironment. A marker capable of detecting the carbohydrate residue of β -D-galactose is the peanut agglutinin lectin (PNA). This allows to use the lectin-histochemical method to study the properties of lymphocytes.

Aim: To study the dynamics of peanut agglutinin lectin (PNA) receptor expression on thymocytes in normal conditions and after prenatal administration of dexamethasone in rats.

Materials and methods: The studies were conducted on 144 white rats on the 1st, 2nd, 3rd, 5th, 9th, 14th, 21st and 30th days after birth. There were 3 groups of 48 rats: group 1 – intact animals (Int), 2 – experimental group, which were intrauterinely administered 0.05 ml of 0.4% dexamethasone solution diluted 1:40 (Dex), group 3-control, which were administered 0.05 ml of 0.9% NaCl (K). The appearance of PNA⁺-lymphocytes was recorded in the ImageJ program.

Results and discussion: The introduction of saline to the K group of animals did not cause significant changes (p<0.05) in the thymus compared to the Int group at all studied periods. (see Charts 1 and 2)

On the 1st-2nd day after birth, in the cortical and medullary regions of the thymus in the Int group, moderate (++) expression of peanut lectin (PNA) receptors is observed. In contrast, in the Dex group, the number of receptors for this lectin is low (+) in both the cortical and medullary regions.

From the 3rd to the 5th day of postnatal life, in the Int group, the density of β -D-galactose receptor distribution in the cortical region decreases, and low (+) intensity of benzidine staining for peanut lectin accumulation is observed. In the experimental group, however, this indicator increases (++) during the same period.

In the medullary region of the thymus, the PNA⁺-structure content increases in the Dex group and remains moderate (++) in all studied groups on the 3rd day. On the 5th day, it decreases to a low level (+) until the 9th day, in all animal groups.

On the 9th day after birth, in the cortical region of the thymus, the intensity of benzidine staining for peanut lectin accumulation increases and is recorded at a moderate level in both the Int (++) and Dex (++) groups.

Distribution of peanut lectin (PNA) receptors in the cortical region of the

Day	Int	Dex	K
1st	++	+	++
2nd	++	+	++
3rd	+	++	+
5th	+	++	+
9th	++	++	++
14th	+	++	+
21st	+	+	+
30th	++	++	++
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thymus of rats during the postnatal period

Note: Int - intact group, K - control group, Dex - experimental group after dexamethasone administration.

Chart 2

Distribution of peanut lectin (PNA) receptors in the medullary region of the thymus of rats during the postnatal period

Day	Int	Dex	K
1st	++	+	++
2nd	++	+	++
3rd	++	++	++
5th	+	+	+
9th	+	+	+
14th	++	+	++
21st	+	+	+
30th	+	+	+

Note: Int – intact group, K – control group, Dex – experimental group after dexamethasone administration.

On the 14th day of life, in the cortical region, there is a decrease in the receptor distribution density for β -D-galactose conjugates in the Int group (+), while in the Dex group, it remains at the previous level (++). In the medullary region of the thymus, however, in the Int animals, an increase in (++) intensity of β -D-galactose receptor expression is observed, while in the Dex group, this indicator remains at the previous level (+).

On the 21st day after birth, there are no differences in the receptor distribution density for peanut lectin between the groups in both morpho-functional regions of the thymus. The intensity of benzidine staining is at a low (+) level.

On the 30th day of life, in the cortical region of the thymus, an increase in the expression of receptors for β -D-galactose residues is noted in all groups, with the intensity of this indicator recorded at a moderate level (++). In the medullary region, the density of peanut lectin receptor distribution does not change compared to the 21st day (+) and does not differ between the groups.

Conclusions: In the Int group of animals, the intensity of peanut lectin (PNA) receptor expression exhibits a wave-like pattern throughout the entire observation period, reflecting normal processes of intrathymic migration and maturation of lymphocytes in different thymic compartments.

It was found that after the administration of dexamethasone to the experimental group of animals on the 18th day of pregnancy, the intensity of β -D-galactose receptor expression increases in the cortical region until the 14th day after birth, except on the 1st to 2nd day, when low expression intensity is observed. In the medullary region, low intensity of peanut lectin (PNA) receptor expression is registered throughout the entire observation period. These differences characterize a significantly delayed and gradual increase in immature lymphocyte forms, as a compensatory response following hormone-induced apoptosis of thymocytes.

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