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Pathomorphologic Changes of Uterus with the Development of Alimentary Magnesium Deficiency and in Sulfate and Taurine Magnesium Correction States

ABSTRACT

In this research we established structural changes in all layers of rats' uterus due to alimentary magnesium deficiency accompanied by significant deviations of quantitative morphological indices that testify to multidirectional dynamics of changes with prevalence of impaired blood circulation and development of atrophic processes. When carrying out pharmacological correction of alimentary magnesium deficiency by magnesium sulfate and magnesium taurinat there has been positive dynamics of various on expressiveness with compensatory and adaptive changes in an uterus.

Keywords: alimentary magnesium deficiency, reproductive system, uterus.

INTRODUCTION

In the study of pathology of pregnancy and childbirth, researchers mostly take into account a problem of magnesium deficiency states [5]. In practice for the prevention and treatment of hypertonic uterine dysfunction of the fetoplacental system and generic activities can be used in a variety of magnesium-containing drugs [12, 7]. Study of the structural mechanisms of the influence of magnesium deficiency on the organs of the female reproductive system and the search for the optimal drugs used for pharmacological correction of pathological conditions associated with miscarriage and pathological conditions of delivery, is an important issue of obstetrics and gynecology [8]. In addition, data on the degree of compensatory changes in the uterus in terms formed deficiency of magnesium state and its pharmacological correction of various preparations of magnesium remains controversial [11, 9]. The search for regularities in the development of pathological changes is an important task and at the present time. Therefore, the purpose of this study is to identify major patterns of morphological changes in the uterus of rats at dietary deficiency of magnesium and its pharmacological correction in conditions of experimental simulation.

MATERIALS AND METHODS

The study was conducted at 70 outbred rats females, weighing 180-200 g at the age of 6 months. 1-St group [n=10] was intact females. To determine the phase of the sexual cycle for 10 consecutive days, each female was taken vaginal swab to determine the phase and the patterns of flow of the ovulatory cycle in selected into the experiment animals. In the 2nd group [n=10] included females who were at deficiency of magnesium diet for 12 weeks. Modeling dietary deficiency of magnesium was performed using a special deficiency of magnesium diet similar to the diet, manufactured by MP Biomedicals (Aurora, Ohio, USA) with a 3.5% mineral content of the mixture that does not contain magnesium. All diets were prepared using deionized water, the same water during the experiment was used as drinking water for animals on a diet. The speed and depth of the development of hypomagnesaemia controlled by defining the content of

magnesium in plasma and erythrocytes of animals, spectrophotometric method for color reaction with titanium yellow [6].

The 3rd [n=10] and 4th [n=10] group included females who had no magnesium diet for 12 weeks and since 9 to 12 weeks were treated orally through a feeding tube 50 mg/kg of body weight nutritional magnesium as magnesium sulfate (Magnesium sulphate), magnesium taurinate (Magnesium N-acetyltaurate), respectively.

Morphometric research was conducted with use of the program Video Test Morfo 4, statistical processing is carried out with use of the standard software package of Statistika 6.0 for Windows. For all types of the analysis as the statistically significant considered distinctions at $p < 0,05$ [1, 3].

RESULTS

Histological examination of the uterus experimental animals with non-magnesium diet (group 2), we found out that pathological changes were manifested in the form of nonspecific changes, vascular disruption of the microcirculation with subsequent pathological changes of endometrium and myometrium. Endometrial stroma was sealed with a small amount and uneven location of the uterine glands. From microvasculature of the endometrium were observed partial empty vessels. Myometrium was characterized by degenerative changes of myocytes with vacuolization of the cytoplasm, swelling intermuscular space and a plethora of microcirculatory vessels. In the stroma, compared with the control group there was a decrease in the number of eosinophils in 10.7 times ($p < 0.05$) with the presence of isolated lymphocytes. According to a study it was found that the weight of the uterus of rats by without the magnesium diets decreased by 66% ($p < 0.05$). When morphometric comparison with the control group, the thickness of the wall of the uterus was reduced by 70% ($p < 0.05$), and the thickness of the walls of blood vessels increased by 35 % ($p < 0.05$). Decreased the volume fraction of the endometrial glands, 40% ($p < 0.05$), the height of a single layer of columnar epithelium and the volume fraction of the cores of the single-layer columnar epithelium, increased by 48% ($p < 0.05$) and 50% ($p < 0.05$), respectively.

When determining the duration of the estrous cycle in animals of the 2nd group there was an increase in the duration of the dioestrus phase 2 week 94,12 % ($p < 0.05$), proestrus 100% ($p < 0.05$), duration of estrus phase decreased by 46,94 % ($p < 0.05$). On the 2nd month of the study significantly decreased the duration of the phase of the estrus at deficiency of magnesium animals on 43,33 % ($p < 0.01$). When carrying out the correction of nutritional deficiency of magnesium has been a slight increase in the duration of estrus phase and decrease the duration of phase proestrus the infusion of magnesium-containing drugs.

In the correction of nutritional deficiency of magnesium with drugs such as magnesium sulfate and taurinate magnesium, endometrial thickness was significantly decreased by 36.6% ($p < 0.05$) and 27% ($p < 0.05$), respectively, relative to the control group, but noted that the increase in endometrial thickness in relation to the group nutritional deficiency of magnesium on 107,24% ($p < 0.05$), and in the correction of taurinate magnesium 138.48% ($p < 0.05$).

In the study of the myometrium in animals of the 3rd group (correction magnesium sulfate) there was increase of its thickness on 26,29% ($p < 0.05$) in animals of the 4th group

(correction taurinate magnesium) thickness of the myometrium decreased by 10,48% ($p<0.05$) relative to the intact group.

According to the morphometric study in the 4th group (taurinate magnesium correction) ekzokrinotsit glands returned to normal, and the volume fraction of the cores of ekzokrinotsit glands significantly increased by 56,95 % ($p<0.05$), compared with the control group. When correcting magnesium sulfate height of ekzokrinotsit glands was significantly decreased by 42.45% ($p<0.05$), volume ratio (VR) of nuclei ekzokrinotsit cores glands was increased by 43,69% ($p<0.05$) as compared to intact animals (table 1).

DISCUSSION

We found out structural changes in the uterine wall at the nutritional magnesium deficiency and disruption of the estrous cycle indicate that inhibition of reproductive function developed as a result of electrolyte imbalance, pathomorphological changes in microcirculatory vessels, as evidenced by the decrease in the concentration of magnesium in the blood plasma of experimental animals and is consistent with the available experimental data, and typical age-related disorders of the reproductive system, and may be associated with impaired hypothalamic-pituitary regulation [4].

When correcting the deficiency of magnesium status with magnesium drugs, structural changes of the uterus is less expressed, as evidenced by qualitative changes: the reduction of the phenomena of swelling, disruption of the connective tissue of all layers of the uterus and its vascular system, evidenced by the results of morphometric studies, and literature data [10, 2], which appears to be associated with activation of compensatory mechanisms and vasoprotective and anti-inflammatory effects of various salts of magnesium.

CONCLUSIONS

Thus, it was found that the modeling deficiency of magnesium state observed structural changes in all layers of the uterus in rats, accompanied by significant deviations quantitative morphological indicators showing mixed dynamics change with the prevalence of circulatory disorders and the development of atrophic processes of nature.

When pharmacological correction of nutritional deficiency of magnesium taurinate or magnesium sulfate resulted in incomplete recovery of the structural components of the endometrium and myometrium, accompanied by increase in volume fraction of the uterine glands to control values when using magnesium sulfate, which indicates the existence of differences in drug pathomorphosis deficiency of magnesium condition and may explain the differences in the nature and dynamics of changes in reproductive function of rats.

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Morphometric indices	The control (intact)	Magnesium deficiency	Magnesium sulfate	Taurinate magnesium
Endometrial thickness, μm	1326,5 $\pm$ 124,5	405,6 $\pm$ 9,8*	840,6 $\pm$ 22,1* [#]	967,3 $\pm$ 24,4* [#]
The thickness of the myometrium, μm	559,1 $\pm$ 12,3	168,5 $\pm$ 4,20*	706,1 $\pm$ 11,0* [#]	500,5 $\pm$ 13,6* [#]
The wall thickness of the vessels in the myometrium, μm	26,2 $\pm$ 0,2	35,5 $\pm$ 0,7*	34,01 $\pm$ 0,4*	30,3 $\pm$ 0,4* [#]
The volume fraction of the endometrial glands, %	3,8 $\pm$ 0,5	2,3 $\pm$ 0,1*	4,1 $\pm$ 0,3 [#]	2,3 $\pm$ 0,6*
The height of a single layer of columnar epithelium, μm	35,9 $\pm$ 2,5	53,3 $\pm$ 5,9*	30,5 $\pm$ 0,4* [#]	54,4 $\pm$ 0,6*
The volume fraction of the cores of the single-layer columnar epithelium, %	30,1 $\pm$ 4,7	39,2 $\pm$ 2,8*	46,2 $\pm$ 2,8* [#]	43,4 $\pm$ 1,3* [#]
Height of glands, μm	36,49 $\pm$ 3,3	16,5 $\pm$ 0,2*	21,0 $\pm$ 0,2* [#]	36,6 $\pm$ 0,3 [#]
The volume fraction of the cores Associacao glands, %	30,9 $\pm$ 2,1	39,4 $\pm$ 2,7*	44,4 $\pm$ 2,7* [#]	48,5 $\pm$ 1,7* [#]

* the results are valid relative to the control group when $p < 0.05$;

- the results are valid for nutritional deficiency of magnesium at $p < 0.05$.