II International Scientific Conference «Innovative Technologies of Nuclear Medicine and Radiation Diagnostics and Therapy»

LITHIUM FOR NEUTRON CAPTURE THERAPY: THE CURRENT STATE AND PERSPECTIVES

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Oncological diseases occupies a leading position in the structure of mortality throughout the world and despite the development of diagnostic and treatment technologies, the incidence of cancer continues to grow [1]. Boron neutron capture therapy (BNCT) is a form of binary radiotherapy based on the high ability of the non-radioactive ^{10}B isotope to absorb thermal neutrons. The nuclear reaction $^{10}B(n,\alpha)^{7}Li$ occurs with the release of 84% of the energy within one cell, which leads to its death [2].

The usage lithium isotope instead of boron leads to the $^{6}Li(n,\alpha)^{3}H$ reaction, which products α-particle and tritium have high linear energy transfer characteristics, can provide 100% local energy release.

The aim of the study was to determine parameters of lithium biodistribution and to evaluate structural changes in the kidney after administration of lithium carbonate for the implementation of lithium neutron capture therapy (LiNCT).

B16 mouse melanoma cell culture was subcutaneously injected to C57BL/6 mice. When the tumors reached the target volume, the animals were divided into 11 groups: control group, 5 groups that were administrated lithium carbonate at a dose of 300 mg/kg and 5 groups – at a dose 400 mg/kg *per os*. Biological samples (blood, skin, kidneys, brain and tumor) was collected 15 minutes, 30 minutes, 90 minutes, 180 minutes and 7 days after an administration of lithium carbonate. Lithium concentrations in blood and organs were assessed by ICP AES. Kidney mor-

phology was studied using light and transmission electron microscopy; immunohistochemical staining was used to analyze the expression levels of the acute kidney injury marker proteins Kim1 and NGAL.

The maximal concentration of lithium in the tumor in mice with skin melanoma B16 was detected 30 minutes after lithium carbonate administration at a dose of 400 mg/kg. The highest lithium concentrations are determined in the kidneys. Lithium concentrations in all studied samples (brain, kidneys, skin, tumor and blood) decreased to background values in 7 days.

The results of light and transmission electron microscopy of the kidney did not reveal statistically significant differences found between control and experimental groups.

The expression of protein markers of acute kidney injury Kim1 and NGAL increases 30 and 90 minutes after a single administration of lithium carbonate at a dose of 400 mg/kg and gradually decreases to the control values after 7 days.

Lithium uptake by tumor tissue was quite effective, and single administration of high doses of lithium carbonate did not cause structural changes in the kidney. The high expression of acute kidney injury markers in the kidney was reversible. Thus, the developed protocol of lithium carbonate administration may be used in future experiments in lithium neutron capture therapy.

Acknowledgments: This research was funded by the Russian Science Foundation (grant number 19-72-30005).

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