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Gd SELF-SHIELDING EFFECT IN NCT EXPERIMENTS WITH MAGNEVIST

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Taking into account the effect of Gd self-shielding in experiments with Magnevist on Gd NCT significantly improves the accuracy of determining the absorbed dose. As is known, collimated neutron beams are mainly used in NCT, therefore, the bulk of thermal neutrons fall from the front side and, at a high concentration of gadolinium, are absorbed by the front layers of gadolinium. In work [1], the effect of self-shielding was confirmed by calculations using MSNP for modeling and when measuring the dose of gadolinium using chemical Frice dosimeters. The effect of self-shielding when using a drugs based on 10B and B4C was also investigated in works [2,3]. It is especially important to consider this effect when conducting radiobiological experiments, since excess concentration of gadolinium can lead to an underestimation of the expected dose in the tumor or to the irregularity of its exposure. In this paper, we present the results of calculations of the MCNP simulation of experiments on epithermal neutron irradiation of biopsy samples of human brain glioma tumors. Using these calculations, we performed experiments on tissue samples of human glioma tumors extracted during surgery. From tissue samples of tumors, live sections were prepared and placed in a nutrient medium. Prepared live sections were used to irradiate a beam of epithermal neutrons in the presence of the Magnevist preparation. The dependence of the percentage of necrosis in the samples on the concentration of Gd in human brain glioma tumors was studied experimentally The results showed that the percentage of necrosis in the tissues of human brain tumors linearly depends on the concentration of Gd to 1000 ppm, and with a further increase in the concentration, the percentage of necrosis does not change. This indicates that, due to the above factors, there is a certain optimal concentration of Gd for irradiating human brain glioma tumors, and a further increase in the concentration of Gd can adversely affect, i.e. reduces the absorbed dose. This fact must be taken into account when using various drugs to increase the effectiveness of GdNCT.

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Author: Dr KULABDULLAEV, Gayratulla

Presenter: Dr KULABDULLAEV, Gayratulla

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