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THE USING OF LIVING SLICES OF HUMAN ANAPLASTIC ASTROCYTOMA IN VITRO CONDITIONS IS USEFUL TOOL FOR EVALUATION OF TUMORS SENSITIVITY TO GAMMA IRRADIATION AND GADOLINIUM NEUTRON CAPTURE IRRADIATION.

The aim of study was to evaluate the effectiveness of the method for determining individual radiosensitivity and radioresistance to gamma irradiation and gadolinium neutron capture irradiation using living tissue slices of human anaplastic astrocytomas in vitro conditions. In study 30 patients with clinically and histologically confirmed diagnosis of anaplastic astrocytoma with disease duration of 3 years were included. In gamma irradiation group were included 19 patients and 11 patients were included in the neutron capture irradiation group. In this group, patients were divided into two subgroups –6 patients were included in the first subgroup and in second subgroup 5 patients were included. .

Biopsy samples of human anaplastic astrocytoma tumors were taken during routine surgical operations. The extracted tissues were dissected into slices with standard sizes from 3 to 5 mm thick. For gamma irradiation were used three slices - one slice was irradiated with absorbed dose of 5 Gy, the second slice was irradiated with absorbed dose of 10 Gy and the third slice was irradiated with absorbed dose of 15 Gy in the gamma installation of the INP AS RUz (cobalt-60 with energy peaks of 1.1732 MeV and 1.3325 MeV).

For neutron capture irradiation, a magnetic resonance contrast agent Magnevist (Bayer AG, Germany) was used as a gadolinium-containing drug. Magnevist was added to the slices to a final gadolinium concentration of 32.958 mg/g and used for irradiation with a beam of epithermal neutrons and secondary particles arising from the gadolinium-neutron capture reaction. In the first subgroup, three slices were used for irradiation – one slice was irradiated with absorbed dose of 5 Gy, the second slice was irradiated with absorbed dose of 10 Gy and the third slice was irradiated with absorbed dose of 15 Gy. In the second subgroup, one slice was used for irradiation, which was irradiated with one absorbed dose of 20 or 40 Gy. The irradiation was carried out on the horizontal channel of the WWR-SM reactor of the INP AS RUz at epithermal neutron flux density of 1.5 x 108 n/cm2 ·s. The absorbed dose was calculated using the MNCNP program. After irradiation, the slices were transferred in fresh saline solution with 5% glucose, cooled to 4 ℃, and incubated at 4 ℃ for 24 hours. After incubation, histological analysis was performed to determine the degree of necrosis of the samples.

In the gamma irradiation group of 19 patients (irradiation with doses of 5, 10 and 15 Gy) we found the following distribution of sensitivity to gamma radiation: high sensitivity was observed in 12 out of 19 patients (63.16%), low sensitivity - in 4 out of 19 patients (21.04%) and resistance –in 3 patients from 19 patients (15.80%).

In the neutron capture irradiation group, we found the following distribution in sensitivity to gamma radiation: In the first subgroup of 6 patients (irradiation with doses of 5, 10 and 15 Gy), high sensitivity was observed in 3 patients (50%), one patient (16.7%) showed resistance to radiation doses of 5 and 10 Gy and resistance to all three doses of 5, 10 and 15 Gy was observed in 2 patients (33.3%). In the second subgroup of five patients (irradiation with doses of 20 and 40 Gy) all five patients showed good sensitivity to radiation doses of 20 and 40 Gy.

Thus, the effectiveness of gadolinium neutron capture therapy on living slices of tumors of anaplastic astrocytoma of the human brain has been shown. The data obtained showed that living biopsy slices of human anaplastic astrocytoma can be used as in vitro model to study therapeutic pathomorphosis under irradiation with epithermal neutrons and secondary particles arising from the gadolinium-neutron capture reaction. Such model may prove to be extremely useful tool for testing the effectiveness of various irradiation modes for NCT and new drugs designed to deliver gadolinium to the tumor.

Section

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Primary authors: KIM, Andrey A. (Institute of Nuclear Physics); Dr KULABDULLAEV, G.A.; Ms DJURAEVA,

G.T.; Mr KADYRBEKOV, N.R.; Dr BEKNAZAROV, H.J.; Dr KADYRBEKOV, R.T.

Presenter: KIM, Andrey A. (Institute of Nuclear Physics)

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