DETERMINATION OF DOSE LOADS DURING NCBT WITH ANIMALS

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Neutron capture boron therapy (NCBT) is a radiation science that is a tool for cancer treatment by selectively concentrating boron compounds in tumor cells and then exposing the tumor cells to epithermal radiation from a neutron beam. NCBT produces a nuclear reaction that occurs when boron-10, a stable isotope, is irradiated with low-energy thermal neutrons to form alpha particles (helium - 4) and lithium-7 recoil nuclei.

To conduct research without risk to human life and health, tissue-equivalent phantoms are used, which are very similar in structure and properties to human ones. Their variations are quite extensive. In the course of this work, we will consider the plastic that was studied at the IRT-T reactor, as well as the water phantom, which is under development, but there is already information on its creation.

Currently, a huge number of people suffer from cancer as a result of unfavorable environmental conditions and other factors, so the question of finding the most effective and suitable treatment method for the majority is most acute.

In this paper, it is proposed to determine the dose loads on the body during neutron capture therapy. For this purpose, the paper presents рассмотрениеa direct review of the therapy process; practical research with tissue-equivalent plastic and copper; search for studies with a water phantom for further use of the information found; conducting an experiment with an animal.

With the phantom, 10 calculations were performed for 3-4 measurements. The absorbed dose value decreases as you move away from the gate from the value of 0.389 Gy to the value of 0.120 Gy. Each block of the phantom contained two foils: one with a cadmium filter and one without. The results of calculating the flow density by the cadmium difference method and the data obtained are illustrated in the paper. The flow density also decreases with distance from the gate section from a value of 5.06 neutrons/$cm^2 \cdot s \cdot 10^8$ to a value of 0.37 neutrons/$cm^2 \cdot s \cdot 10^8$.

REFERENCES

1. V. A. Levchenko, Yu. A. Kazansky, V. A. Belugin, A.V. Levchenko, et al., "Neutron-physical and technical characteristics of a medical reactor for neutron therapy", NPP safety and personnel training. IX International Conference: Abstracts (Obninsk, October 24=28, 2005) Part 1. - Obninsk: IATE, 2005.Zyryanov B. N. et al. Remote neutron therapy. – 1991. – c. 35.

2. Smolnikov N. V., Anikin M. N., Naimushin A. G., Lebedev I. I., "Determination of dosimetric loads in biological tissues during neutron capture therapy at the IRT-T reactor" - Tomsk: Scientific Research Institute of TPU, 2018.

THERAPY OF HER2-EXPRESSING HUMAN XENOGRAFTS IN MICE USING 177LU-LABELLED SCAFFOLD PROTEIN ABY-027: COMPATRISON WITH THERAPY USING ANTOBODY TRASTUZUMAB

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We have designed a new agent for radionuclide therapy of HER2-expressing tumours, ABY-027. ABY-027 includes Affibody molecule ZHER2:2891, an albumin binding domain ABD035 and DOTA chelator. ABY-027 was labelled with the beta-emitting radionuclide ^{177}Lu. The aim of this study was to evaluate efficacy of ^{177}Lu-ABY-027 in an animal model.

HER2-expressing human xenografts were obtained by implantation of ovarian carcinoma SKOV3 cells (10^7 cells per mouse) on abdomen area of BALB/C nu/nu mice. Treatment was initiated one week later. The mice were randomized into 4 groups, 10 animal per group. Animals in the experimental therapy group were intravenously injected with 20 MBq (20 µg) of ^{177}Lu-ABY-027. For comparison, animals in another group were treated with 6 injections of trastuzumab, according to clinical protocol, a loading dose (4 mg/kg) followed by weekly doses of 2 mg/kg. One control group was treated with PBS and another with 20 µg of unlabelled ABY-027. Throughout the experiment, tumour volumes and body weights were measured twice per week. The animals were euthanized when tumours reached a size of 1000 mm^3 or became ulcerated, or if an animal's weight dropped by more than 10 % during one week.

The treatment with trastuzumab resulted in the median survival of 55.5 days, which is significantly ($p< 0.05$, log-rank Mantel-Cox test) longer that the median survival of mice in the control groups treated with vehicle (33 days) or unlabelled ABY-027 (42 days). In the group treated with 177Lu-ABY-027, only four animals died by day 75 after tumour inoculation, one because of weight loss and three because of tumour ulceration. Thus, the median survival was not reached and the treartmnt was more efficient than the treatment using trastuzumab. There was a tendency to an excessing weight loss for animals treated with 1^{77}Lu-ABY-027, but the difference with other treatment groups was not significant at any time point ($p>0.05$, one way ANOVA).

In conclusion, treatment of HER2-expressing human xenografts using ^{177}Lu-ABY-027 extends survival of mice compared to controls. It is more efficient than the standard of care for HER2-expressing cancer, treatment using trastuzumab.

ПОЛИМЕРНЫЕ МЕМБРАНЫ С DLC ПОКРЫТИЯМИ ДЛЯ ПРИЛОЖЕНИЙ СЕРДЕЧНО-СОСУДИСТОЙ ХИРУРГИИ

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В работе было выполнено модифицирование полимерных мембран из сополимера винилиденфторида с тетрафторэтиленом (ВДФ-ТФЕ) с помощью вакуумно-дугового испарения графитовой мишени в атмосфере аргона. Цель данной работы - исследование влияния режимов осаждения DLC покрытий на свойства полимерных мембран, применяемых для приложений сердечно-сосудистой хирургии.

Мембраны были получены из 6 масс.% раствора ВДФ–ТФЭ. Модифицирование поверхности мембран осуществляли с помощью метода вакуумно-дугового испарения с графитовой мишенью (МПГ-6) в атмосфере аргона. Морфологию полимерных мембран исследовали методом сканирующей электронной микроскопии (СЭМ). Изображения обрабатывали с помощью программного обеспечения Image J. Прочность на разрыв и относительное удлинение исследовали на разрывной машине Instron 3344. Кристаллическая структура мембран была исследована методом рентгеновской дифракции на дифрактометре XRD 6000. Измерения краевого угла смачивания поверхности и расчет свободной поверхностной энергии (СПЭ) образцов модифицирования проводили с помощью метода лежащей капли на приборе DSA 25. Краевые углы смачивания воды (H_2O) и дийодметана (CH_2I_2), а также поверхностная энергия, были рассчитаны с использованием метода Оунса, Вендта, Рабеля и Кьельбле (ОВРК). Исследование биосовместимости проводилось с использованием фибробластов эмбриона мыши 3T3L1.

В работе показано, что осаждение DLC покрытия на мембраны не изменяло их морфологии, также не наблюдалось изменение структуры мембраны, каких-либо дефектов волокон мембран не наблюдалось. Модифицирование мембраны приводит к снижению предела прочности от 17,8 до 14,0 МПа и относительного