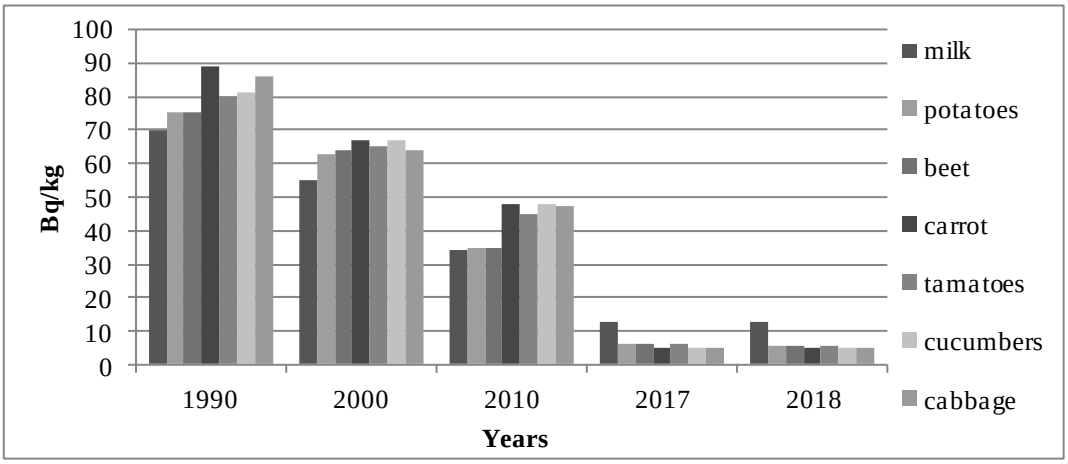

Fig. 1. – Cesium-137 content dynamics in milk and vegetables in Minsk region since 1990 to 2018 ($p < 0.05$)

The highest content of cesium-137 was recorded in 1990 in all investigated products of Minsk region. The highest content of cesium-137 in 1990 was found in root crops and potatoes which is likely due to the more active accumulation of cesium-137 by these crops. Throughout the observation period the level of content is constantly decreasing.

Over the entire period of observation, excess of permissible levels of cesium-137 was not observed. [5, 6]. Today the specific activity of cesium-137 in the studied products is suitable for human consumption.

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VERIFICATION OF THE MULTIMODAL TREATMENT PLAN ABSORBED DOSE AT REFERENSE POINT VALUE AS A MEAN OF ASSESSING THE QUALITY OF DYNAMIC RADIATION THERAPY PROVIDED

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Keywords: intensity modulated radiation therapy, medical physics, treatment planning, medical linear accelerator, verification.

A strict requirement for intensity modulated radiation therapy for cancer patients is the verification of the dose value during radiation plan delivery as approved by the radiation oncologist before starting radiation treatment. This procedure is necessary to control the implementation of an individual treatment plan and the delivery of a complex dose distribution in accordance with the doctor's prescription and the possibility of its implementation under the existing physical limitations of linear accelerators. Verification of each of the calculated treatment plans using intensity modulated radiation therapy techniques requires significant machine time of a linear accelerator and time-consuming for qualified specialists in the field of medical physics [1].

It should be noted that in the event of a breakdown of the linear accelerator, where a significant number of patients have received radiation treatment using dynamic radiation therapy techniques , they should be transferred to another accelerator , which has similar capabilities for irradiation. Nevertheless, due to the incomplete accordance of the parameters of radiation beams and the mechanical characteristics of the devices for forming the irradiation field, it is necessary to verify each irradiation plan for each of the new patients before starting their treatment with the new radiation therapy machine. It is important in this situation that with a large number of verified plans, a queue will arise and patients will be forced to wait for their radiation treatment to continue, and interruptions in ex-isting radiation therapy courses may lead to serious violations in the radiation treatment strategy and significantly reduce the likelihood of local tumor control and increase the likelihood of tumor recurrence [2].

In order to reduce the negative effect on the quality of medical care provided for radiotherapy patients, as a result of the situations described above, the authors developed a method for verifying the point value of the dose, which allows one to evaluate the quality of dynamic radiation therapy performed using a linear accelerator by veri-fying the point value of the absorbed dose for multimodal treatment plan containing typical conditions of exposure typical for the main localizations of malignant tumors treated using intensity modulated radiation therapy.

The irradiation plan proposed for verification includes three sector irradiation fields, including full rotation of the gantry of the linear accelerator (two arcs in the clockwise direction and one arc counterclockwise). Three pho-ton energies are used: 6MV with and without a flattening filter and 10 MV without using a flattening filter using irradiation volumes corresponding to typical clinical cases of irradiation of gastric cancer, a tumor localized in the brain and stereotactic irradiation of metastasis located in the vertebra.

For verification, we used a home-made phantom consisting of plates of a solid-state homogeneous water-equivalent material of phantom RW3 (type T29672, PTW Freiburg) and an ionization chamber PTW 30010 (Farmer type)., The ionization chamber was located in the middle of the whole phantom, above and below it there was a water-equivalent material with a full thickness 4 cm [3].

Using this phantom, one reference measurement of the charge accumulated by the ionization chamber during radiation delivery was performed (67.94 nC) as well as consecutive 10 verification measurements of the proposed verification plan (5 before starting treatment of patients in the morning, 5 in the evening after the end of patient irradiation sessions) to assess the stability of both a linear accelerator and the proposed dosimetric system parameters. Table 1 shows the measurement results obtained for the test plan.

Table 1

Verification measurement results

Day	Morning, nC	Deviation, %	Evening, nC	Deviation, %
1	67,85	0,13	67,97	0,04
2	67,08	1,26	67,76	0,4
3	68,12	0,26	68,11	0,25
4	68,01	0,1	67,97	0
5	68,07	0,19	67,82	0,18

The results obtained show that the developed methodology for verifying the point value of the dose of a multimodal radiation plan is a quick and reliable means of conducting dosimetric measurements of complex individual dose distributions and can be used as a means of assessing the quality of dynamic radiation therapy in the routine practice of radiological departments.

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USE OF STEM CELLS IN ONCOHEMATOLOGY

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The aim of this work is to study the possibility of using stem cells in oncohematology. Diseases combined into a group of hemoblastoses are the most common forms of tumors. 30% of tumors are tumors of children of the first 5 years of life. A significant group of hemoblastoses is leukemia. This is an extensive group of diseases that differ in their etiology and properties. Due to the active introduction of stem cell technology in Belarus, mortality from blood diseases has decreased.

Keywords: oncohematology, hemoblastosis, stem cells, transplantation, hematopoietic stem cells.

Oncohematology is a field of medicine at the junction of hematology and oncology that studies malignant diseases of the hematopoietic system, or the so-called hemoblastoses, as well as pre-malignant myelodysplasias, their causes and development mechanisms, their natural course, diagnosis, treatment and prognosis. Diseases combined into a group of hemoblastoses are the most common forms of tumors.

There are two types of hemoblastoses: leukemia (systemic lesions with primary localization of the process in the bone marrow) and hematosarcomas (non-leukemic hemoblastoses) - regional lesions, characterized by an initially local extramedullary tumor.

The development of hemoblastoses is a complex multi-stage process, which arises in connection with combined influence of external and internal factors. A possible role for the occurrence of hemoblastoses can play ionizing radiation or chemicals that have a mutagenic effect on hematopoietic cells.

One of the sections of regenerative cell medicine that promises people a cure for many serious illnesses is the study of so-called stem cells. A stem cell is an immature cell capable of self-renewal and development into specialized cells of the body. In the adult body stem cells are mainly found in the bone marrow and in all organs and tissues in very small quantities. Bone marrow or stem cell transplantation allows the treatment of leukemia with high doses of chemotherapeutic agents and radiation. A side effect of these methods is the destruction of healthy bone marrow cells. At the end of the chemoradiotherapy course, intact cells are injected intact cells that develop and turn into blood cells to compensate for healthy cells. In other words, bone marrow transplantation is not an independent method of treating leukemia and is used in conjunction with other types of therapy to increase their effectiveness.

Hematopoietic stem cell transplantation has become the greatest application in medicine. It is obtained from bone marrow, cord blood and "stimulated" peripheral blood.

There is a high risk of complications during hematopoietic stem cell transplantation; this procedure is traditionally used for patients with life-threatening diseases. Although hematopoietic cell transplantation is sometimes performed experimentally for non-malignant and non-hematologic diseases (for example, a severe autoimmune or cardiovascular disease), the risk of fatal complications is very high to expand the range of indications for transplantation.

Since 1993, the Republican Center for Hematology and Bone Marrow Transplantation has performed about 1 thousand bone marrow and blood stem cell transplants, and since 1998 about 650 stem cell transplants have been performed for children in the Russian Center for Pediatric Oncology and Hematology. Due to the active introduction of these technologies in Belarus, mortality from blood diseases has decreased. The total number of people who died from hemoblastosis decreased from 2007 to 2012 by 19%, among the working-age population - by 26%. In hematological hospitals of the republican level, patients with acute leukemia receiving program therapy achieved high remission rates of up to 80%. The overall five-year survival rate of patients with hemoblastosis reached 60%, which corresponds to pan-European indicators. These data indicate the need for further development and improvement of this field of science, which will contribute to improving the standard of living among adults and children.

It should be noted that the use of stem cells in the treatment of hemoblastoses is an important area of science and medicine, requiring in-depth consideration, improvement of technology and educated specialists.