DEVELOPMENT OF METHODICAL RECOMMENDATIONS FOR THE ESTABLISHMENT OF PHYSICAL AND TECHNICAL SUPPORT FOR EXTERNAL RADIATION THERAPY PROCEDURES

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The purpose of the work is the development of guidelines that regulate the processes of external beam radiotherapy treatment planning, offer reasonable and minimally sufficient number of quality control procedures for the delivery of planned individual dose distributions for oncological patients, and aimed at optimizing the actions of a medical physicist in typical clinical situations during radiological department operation.

Keywords: medical physics, radiation therapy, protocols, treatment planning, medical linear accelerators.

The specialty "Medical Physics" have been created in the Republic of Belarus in 2012 and the first graduation of such specialists from International Sakharov Environmental Institute of Belarusian State University took place in 2018. In addition, for many years the departments that provided medical and physical support for radiation therapy have successfully operated departments at many oncological institutions of the Republic of Belarus.

At present, radiation therapy is a comprehensive and complex process that includes technological, medical, software, hardware, organizational, economic and other elements that require the coordinated work of a whole team of highly qualified specialists of various specialties. This multidisciplinary team is impossible without a medical physicist involvement [1]. The modern physical and technical support of external beam radiation therapy includes:treatment planning of patient irradiation conditions, quality control and validation of a significant number of technical and dosimetric characteristics of radiotherapy equipment, direct participation in pretreatment preparation and immobilization of patients, verification of patient's irradiation conditions for the dynamic radiation therapy, development and strict observance of an adequate radiation therapy quality assurance programme to guarantee the safety of radiation treatment, as well as qualified operation of complex radiotherapy equipment and ensuring radiation safety of staff members and the patients [2].

A significant part of the actions performed by a medical physicist are carried out directly in the treatment rooms of radiation therapy related devices (medical linear accelerators, gamma-therapy devices, computer tomography scanners, X-ray simulators, brachytherapy devices). It should be noted that all these procedures are performed by specialists while they are in the ionizing radiation exposure zone. The authors evaluated and timed the time of daily work in the field of exposure to ionizing radiation by medical physicists N.N. Alexandrov National Cancer Center of Belarus (Table1).

Table 1

Standard procedures performed by medical physicists

Actions performed	Time spent on the procedure, min
Medical physicist, treatment planning group	
Pretreatment preparation and immobilization of patients	20–30
Monitoring of the quality of patients irradiation (during radiation therapy sessions)	70–100
Plan verifications, quality control	60–120
Medical physicist, radiotherapy equipment operation group	
Monitoring of technical and dosimetric characteristics of radiotherapy equipment	20–30
Radiotherapy equipment operation	240–300
Plan verifications, quality control	60–120

From the data given in table 1 it follows that the daily employment in harmful working conditions of the medical physicist of the treatment planning group of radiation therapy department is 200 minutes, and that of the medical physicist from radiotherapy equipment operation group is 340 minutes on average.

To optimize the time spent by a medical physicist in the field of exposure to ionizing radiation in N. N. The Alexandrov National Cancer Center of Belarus, the authors decided to develop and implement methodological recommendations that regulate the processes of external beam radiation therapy treatment planning and offer reasonable and minimally sufficient number of quality control procedures for the delivery

of the planned individual dose distributions to cancer patients and aimed at optimizing the actions performed by a medical physicist in typical clinical situations during his job in radiological departments. These guidelines will include regulations related to labor protection and radiation protection standards, which will increase the safety of specialists who work directly in the field of exposure to ionizing radiation.

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DEVELOPMENT OF METHODICAL RECOMMENDATIONS REGULATING THE SELECTION OF EXTERNAL BEAM RADIATION THERAPY TECHNIQUE AND PARAMETERS OF TREATMENT PLANNING

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The main requirement for radiation protection of cancer patients during radiation therapy is the maximal possible reduction of the absorbed dose to normal tissues and organs surrounding the tumor while high dose values are still cover the irradiated target itself. The aim of the work is to develop the relevant regulatory documentation, the introduction of which in the clinical practice of radiological departments will improve the quality of the treatment process and reduce the time of unintended stay of staff and patients in the area of exposure to ionizing radiation.

Keywords: oncology, radiation therapy, medical physics, treatment planning, medical linear accelerator.

According the International Agency for Research on Cancer (IARC) and the World Health Organization (WHO), every year around ten million new cases of cancer are registered in the world and this number will only increase over time. It should be noted that more than half of all cancer patients are should undergo radiation therapy. For the safe and effective implementation of high-tech methods of radiation therapy, all procedures related to the physical and technical aspects of patient irradiation should be strictly regulated and adequate guidelines should be used when choosing methods and parameters for dosimetric planning of external beam radiation therapy[1].

Nowadays, the process of external beam radiation therapy includes pre-radiation preparation of the patient, dosimetric planning of the conditions of radiation treatment, verification of the treatment plan and irradiation of the patient using the radiotherapy machine. At the stage of preradiation preparation, computed tomography is performed, and the volumes of radiation and critical organs are contoured using the reconstructed three-dimensional CT images obtained. Next, treatment plans are created and verified, after which the patient is irradiated according to the calculated paramenters (Figure 1).

The patient's preradiation preparation and radiation treatment procedures are carried out using sources of ionizing radiation. Ionizing radiation is an environmental factor that negatively affects human health. The rationale for its use in oncology is the fact that with the same absorbed dose, cancer cells are destroyed faster than healthy ones. Consequently during the radiation treatment, the patient is exposed to radiation exposure, the benefit of which at the moment exceeds the harm.

However, when providing radiation therapy, the main requirement is to ensure local tumor control, while avoiding exceeding tolerant doses to healthy tissues and organs. To fulfill these requirements, a medical physicist should be guided by methodological recommendations that regulate the conditions and clinical situations for which it is necessary to apply various methods of radiation planning, including relying on the maximum permissible absorbed dose values for the patient's healthy organs. When implementing an irradiation plan, a patient is in the area of ionizing radiation for 1 to 20 minutes depending on the chosen radiation therapy technique, which should also be taken into account during treatment planning.