HIGHER LEVEL OF TRAINING OF SPECIALIZED STAFF IS THE KEY TO DEVELOPMENT OF MEDICAL PHYSICS

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ABSTRACT. *This article outlines the role of modern medical physics and outlines the prospects for its development. Particular attention is paid to modern diagnostic devices operating on the basis of physical laws, which are already widely used in the diagnosis, treatment and prevention of certain diseases. Also, several innovative interactive methods and approaches have been proposed for conducting lessons in the field of radiation physics for the training of specialized personnel.*

Key words: medical physics, competence-based approach, specialized personnel, clinical medicine, X-ray diagnostics, radiopharmaceuticals, interactive training, educational process, qualifications, nuclear medicine.

INTRODUCTION. Despite the relatively short history of development, modern medical physics (MPh) has already become a full-fledged section of both applied physics and clinical medicine. It has turned into a powerful and effective means of solving a number of complex medical problems, including those that, in principle, cannot be solved by other means and methods of other branches of knowledge. We can safely say that thanks to the MPh, hundreds of thousands of lives have already been saved and extended, the quality of life of many millions of patients has been improved, especially in oncology. The high relevance of the tasks solved by the MF determines its current rapid development, especially of complex diagnostic and treatment units, apparatus and equipment, and, first of all, high radiation and medical technologies. An analysis of the current state and trends in the development of radiation therapy, nuclear medicine, X-ray diagnostics and other branches of physical medicine shows that a number of qualitatively new advances in the field of MPh should be expected in the near future.

Main part. To date, the use of radionuclide sources for contact irradiation, including for interstitial, intracavitary and intravascular, follows the path of automated irradiation control, when the number and location of sources change in real time according to a given program. For both remote and contact irradiation, it is quite promising to use static and dynamic magnetic fields to twist the trajectories of secondary electrons in the irradiated target in order to increase the energy release in it. Giving such capabilities even to existing devices allows you to really increase the effectiveness of radiation treatment. In the pre-radiation preparation of patients, especially for obtaining three-dimensional topometric information, multimodal tomography systems appear. They use combined computer systems with tools not only for structural and anatomical (X-ray, ultrasound, CT, MRI), but also functional (SPECT, PET, MR-angiography) visualization for ultra-precise determination of the three-dimensional configuration, localization and structure of the pathological focus. The same systems are actively used for refined diagnostics, monitoring the effectiveness of treatment, providing feedback and thus for operational management of the treatment process. The use of X-ray tomography simulators is expanding to ensure the quality of radiation therapy.

Irradiation becomes optimal in the strict sense of the word for each patient due not only to individual dosimetric planning, but also to the choice of an individual radiation fractionation mode based on radiobiological modeling. In this case, the parameters of the model are determined on the basis of the results of dynamic monitoring of the state of the tumor and the patient's body during the course of radiation therapy using various diagnostic technologies, among which the most informative is radionuclide diagnostics. Further development of such modeling will take into account the effect and subsequently optimize the modes of application of such radio modifiers as: hyperthermia, laser exposure, magnetotherapy, electron-acceptor compounds, hypoxia, etc.

The prospects for its further development are associated, first of all, with the increasingly expanding development of new radiopharmaceuticals with increased tissue specificity, especially with increased tumorotropicity. Areas related to the hardware, technological and software-algorithmic support of nuclear medicine are also progressing. Undoubtedly, the proportion of PET studies is steadily increasing, especially in oncology, cardiology and neurology. Emission-tomographic scanners are being developed for simultaneous SPECT and PET, which have high sensitivity due to the use of new scintillators and improved systems for collimation of photon radiation and allow simultaneous recording of emission-transmission data with high spatial and temporal resolution in the list mode of their accumulation and with the movement of the detector heads along trajectories adapted to the specific surface of the research object. Spectrometric tools and technologies for measuring the spatial distribution of radiopharmaceuticals (RFP) are being developed by increasing the sensitivity and spatial resolution.

RESULTS AND DISCUSSIONS. When proposing teaching methods in the preparation of specialists - personnel in the field of MPh, it is very important to take into account that the competence-based approach when organizing the educational process at a university requires the teacher to change the learning process: its structure, forms of organization of activity, principles of interaction between subjects. And this means that priority in the work of a teacher is given to dialogical methods of communication, joint searches for truth, and various creative activities. And all this is realized through the use of interactive teaching methods.

The word *"interactive"* came to us from English from the word *"interact". "Inter"* is "mutual", *"act"* is to act. That is, *interactivity* means the ability to interact or be in the mode of conversation, dialogue with someone (person) or something (for example, a computer).

Interactive learning is a special form of organizing cognitive activity, a method of cognition carried out in the form of joint activities of students. All students interact with each other, exchange information, jointly solve problems, simulate situations, evaluate the actions of others and their own behavior, immerse themselves in a real atmosphere of business cooperation to resolve a problem. One of the goals is to create comfortable learning conditions, such that the student feels his own success, his intellectual competence, which makes the learning process productive.

The educational process is organized in such a way that almost all students are involved in the learning process, they have the opportunity to understand and reflect on what they know and think. The peculiarity of interactive methods is a high level of mutually directed activity of subjects of interaction, emotional, spiritual unity of students.

Compared to traditional forms of conducting classes, in interactive teaching, the interaction of a teacher and a student is changing: the teacher's activity gives way to student activity, and the teacher's task is to create conditions for their initiative.

In the course of interactive learning, students learn to think critically, solve complex problems based on the analysis of circumstances and relevant information, weigh alternative opinions, make thoughtful decisions, participate in discussions, communicate with other people. To do this, pair and group work is organized in the classroom, research projects, role-playing games are used, work is underway with documents and various sources of information, and creative work is used.

The student becomes a full participant in the educational process, his experience is the main source of educational knowledge. The teacher does not give ready-made knowledge, but encourages students to search on their own and performs the function of an assistant in their work.

First of all, interactive forms of conducting classes:

- arouse students' interest;
- encourage the active participation of everyone in the educational process;
- appeal to the feelings of each student;
- contribute to the effective assimilation of educational material;
- have a multifaceted impact on students;
- provide feedback (audience response);
- form students' opinions and attitudes;
- form life skills;
- contribute to behavior change.

The most important condition for this is the teacher's personal experience of participation in interactive training sessions. You can learn them only through personal participation in the game, *"brainstorming"* or *"discussion".*

All interactive learning technologies are divided into *non-imitative* and *imitative.*

Non-simulation technologies do not imply the construction of models of the studied phenomenon and activity.

Simulation technologies are based on imitation or imitation-game modeling, i.e. reproduction in learning conditions of processes occurring in a real system.

Modern pedagogy is rich in a whole arsenal of interactive approaches, among which the following can be distinguished:

- creative tasks;
- work in small groups;
- educational games (role-playing games, imitations, business games);
- use of public resources (invitation of a specialist, excursions);
- social projects and other out-of-class teaching methods (competitions, interviews, films, performances, exhibitions);
- study and consolidation of new material (interactive lecture, work with visual aids, video and audio materials, "student as a teacher", "everyone teaches everyone", mosaic (openwork saw), use of questions, Socratic dialogue);
- testing;
- warm-ups;
- Feedback;
- distance learning.
- discussion of complex and debatable issues and problems (take a position, scale of opinions, POPS-formula);
- problem solving *("decision tree", "brainstorming", "analysis of incidents", "ladders and snakes");*
- trainings, etc.

CONCLUSION. Considering the prospects for the further development of medical physics and technology, it should be concluded that their implementation and introduction into clinical practice will lead to a qualitative leap not only in medical radiology, but also in other important areas of clinical medicine related to it, especially in oncology, cardiology, and neurology etc. MPh will make medicine an exact science and will significantly expand its possibilities.

It is obvious that the development and introduction into clinical practice of new increasingly complex and effective medical and physical means and technologies imposes the highest requirements on the qualifications of medical physicists, technical engineers, radiation oncologists, radiologists and other specialists involved in the creation and use of these technologies and devices. The embodiment of all these prospects depends not only on the general scientific and technological progress, but also on the implementation of a system of serious organizational and economic measures, especially in our country. When financing and organizing scientific research, production and implementation, the creation of special educational, service and clinical structures; training and professional development of personnel; the creation and maintenance of a whole system of effective use of complex medical and physical technologies and equipment, already in the foreseeable future, a tangible positive effect can be expected.

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