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Status of Radiotherapy and results of TLD postal dose quality audit in Ukraine

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Radiation therapy (RT) is one of the main treatment modalities for cancer patients. The effectiveness of radiation therapy depends on highly specialized equipment, the accuracy of delivery of absorbed dose to target tumor and staff qualification.

The population of Ukraine is approximately 43 million. According to Ukrainian Cancer Registry statistics (Bulletin № 17, 2016) there were 125 424 new cancer cases registered in 2015. Crude incidence rate was 345.9 per 100 000 of population (356.8/100 000 males and 336.5/100 000 females). Currently, there are 53 Oncology centers in Ukraine with radiotherapy equipment including four private Oncology clinics. The information about status of radiotherapy in Ukraine has been collected by the IAEA's annual survey DIRAC for all Ukrainian radiotherapy departments through National Coordinator –Grigorev Institute for Medical Radiology (IMR).

The summarized data on radiotherapy equipment is presented. There are 103 teletherapy units in radiotherapy departments, including 80 Cobalt units (Co-60 radiation source) and 23 linear accelerators. Currently 45 Cobalt units (56.3 %) are in use for about 20 years or more and only 23 units (28.8 %) –less than 10 years. More than 50% of Cobalt radiotherapy units have the radiation sources Co-60 with the lifetime more than 10 years. There are also 42 brachytherapy units (6 units with Ir-192 source and 36 units with Co-60 sources) in Ukraine. Nine of them are not operational due to the absence of radiation sources.

There are 36 CT and 5 conventional (X-ray) simulators in use. In total 18 radiotherapy departments are operation without simulators. There are 60 treatment planning systems (TPS) in radiotherapy in 35 Oncology centers (66 % of total). In the remaining 34 % oncology centers the dose calculation for patient irradiation is still performed manually.

One of the ways to detect possible errors of the delivered dose in radiotherapy is to conduct independent external audits of the dose calibration quality for radiation beams. Ukraine participates in IAEA/WHO TLD postal audit of dose calibration quality for radiotherapy beams since 1998 (IMR –National Coordinator). During the period 1998-2015 the 48 Oncology Centers took part in IAEA/WHO TLD -audit. A total number of checked radiation beams were 356 (15-25 beams per year). The results of the audit showed that about 25-30% of teletherapy units exceeded the 5% acceptance error limit. According to the national survey of radiotherapy departments the clinical dosimetry carried out not in all departments due to absence of modern dosimetric equipment, irregularly maintenance of teletherapy machines and low qualification of staff.

In the framework of National TC-Project UKR/6/010 “Developing and Implementing a National Quality Control System by Strengthening the Knowledge and Capacity of Medical Physics at Radiotherapy Departments” (2012-2013) there were three training workshops organized for medical physicists of Oncology centers: the two workshops on topic - Radiotherapy Practice at the Oncology (Clinical dosimetry) and one on topic - Commissioning and QA of Treatment Planning Systems. Also 25 complete sets of the equipment for clinical dosimetry were provided for radiotherapy departments of Regional and Municipal Oncology Hospitals of Ukraine under this IAEA TC-project.

After IAEA technical support (training of medical physicists, implementation of International Code of Practice TRS № 398, and the use of modern clinical dosimetry sets) the results of TLD-audit in 2014 demonstrated the positive impact on improvement of the quality of clinical dosimetry in RT departments. The limit of acceptance error 5% was exceeded only for two teletherapy units (about 6% of total number audited units).

The annual DIRAC survey of radiotherapy departments gives a possibility to monitor and assess the situation

regarding equipment and staff in RT departments of Ukraine. Unfortunately at present the level of radiotherapy facilities is not sufficient for quality treatment for patients requiring radiotherapy. The main priority needs of radiotherapy departments in Ukraine identified through DIRAC survey and TLD-audit include are: replacement of radiation sources for Cobalt radiotherapy units; modernization of equipment using for radiotherapy –CT simulators and treatment planning systems; creation and implementation of a National Protocol to determine the absorbed dose in the external beam radiotherapy and permanent training of medical staff including medical physicists.

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