EP-1308 IAEA support to national audit networks for radiotherapy dosimetry.

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Planning. No systematic non-conformances with dose-volume and planning requirements have been observed from the responses to date, but some deviations from the required dose reporting protocol were found in returns from 10 of the 32 reporting centres.

Conclusions: The pre-trial RTQA undertaken to date has highlighted some issues in outlining and planning but appropriate dialogue between the RTQA team and the participating centres has allowed these issues to be addressed. Thus the overall aim of compliance with protocol for all participating centres should be achievable. An on-trial QA process will also help support this requirement and is ongoing.

EP-1308
IAEA support to national audit networks for radiotherapy dosimetry
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Purpose/Objective: The IAEA has along-standing history providing support and assistance for radiotherapy dosimetry audits in various countries. It has supported the development of methodology and establishment of several national TLD-based QA audit networks for radiotherapy dosimetry. The main objective was to extend the availability of radiotherapy dosimetry audits to as many radiotherapy centres as possible throughout the world.

Materials and Methods: A series of Co-ordinated Research Projects (CRPs) has been conducted by the IAEA as of 1995 to assist in developing such national dosimetry audit programmes. The overall radiotherapy dosimetry audit approach established and developed throughout these CRPs is based on a process of increasingly complex steps and parameters being checked. The first CRP focused on the basic beam calibration audits. The basic programme was extended to audits in non-reference conditions through a second CRP. The third CRP concluded in 2012, has expanded the dosimetry audit tools for more complex techniques used for treatment of cancer patients. This approach was developed so that experience of previous levels is used to inform development, implementation and analysis of results for subsequent levels.

Results: New procedures have been developed that include TLD based dosimetry for irregular fields, for heterogeneous situations, and for small MLC shaped fields relevant to stereotactic radiotherapy which had applicable to dosimetry for IMRT. In addition the programme included a new development of film-based 2D dosimetry methodology for testing dose distributions in small field geometry. The IAEA Dosimetry Laboratory has actively participated in the experimental part of these CRPs, provided new phantoms and conducted multicentre pilot studies to test the newly developed methodology. The national audit networks participating in these CRPs have incorporated in their programmes procedures for auditing hospital dosimetry for these techniques. In addition, the IAEA contributes to strengthening QA of the national TLD systems by exchanging dosimeters and verifying the TLD work of the national auditing organizations.

Conclusions: Through the link with the IAEA Dosimetry Laboratory, the national audit networks closely cooperate at the consecutive stages of developing the dosimetry audit methodology locally and by carrying out cross-measurements. In this way the national audit systems are interlinked to ensure that international and national radiotherapy dosimetry audit networks are working to the consistent levels and standards. When broadly implemented, the network of national audit groups for radiotherapy dosimetry will contribute to ensuring the consistency of quality in dosimetry in radiotherapy centres world-wide.

EP-1309
Dosimetry audit of the entire radiotherapy process using lithium formate EPR dosimeters
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Purpose/Objective: The purpose was to develop a mailed audit dosimetry system that takes into account influences from the whole treatment chain including CT scanning, treatment planning and treatment delivery. The purpose was also to use the audit system in our healthcare region to verify the quality of head and neck radiotherapy at the four included clinics.

Materials and Methods: A semi-anthropomorphic phantom was constructed, designed to mimic the head and neck region. The phantom was made of PMMA, including a tumour structure partially encompassing the spinal column (made of Teflon), two structures resembling salivary glands, and a small air cavity symbolising the trachea. PMMA rods containing lithium formate EPR (electron paramagnetic resonance) dosimeters were inserted at six different measurement points in the phantom, three in the target volume, one in each salivary gland and one in medulla. The phantom was sent by mail to the audit sites where it was treated as a patient; including CT scan, dose planning and treatment delivery. A conventional five-field dose plan was used. After a complete treatment, the phantom was sent back together with the absorbed doses reported by the treatment planning system.

Results: Audit measurements have been performed at all four clinics in the health care region, results are seen in figure 1.

Figure 1. Results from audit measurements showing the deviation (in percent) between measured and calculated absorbed dose in the six different measurement points.

Except for one clinic, all target and medulla measurement points agree within 1.5% between measured and calculated doses. The result for the two salivary glands shows a larger deviation, mainly because of the steep dose gradient over these structures. One clinic (triangle) is deviating compared to the other clinics. After additional measurements, the most likely explanation is a handling mistake. Within these clinics there are three different dose planning systems in use: pencil beam convolution, anisotropic analytic algorithm and collapsed cone. No significant difference can be seen between the different algorithms. The mailing procedure worked satisfactory and the stability of the dosimeters was not affected by the transport.

Conclusions: We find that the elaborated system provides a useful tool to ensure the quality of the radiotherapy treatments delivered in a clinic, especially when introducing new treatment modalities. Our future plans are to use the audit system for IMRT tand or VMAT audits in the region and in the extension perform a national audit.

EP-1310
Brand-new vertical layout proton therapy system
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Purpose/Objective: Brand-new vertical layout type of small proton therapy system (PTS) has been developed. The first system has been installed at Aizawa Hospital in Japan since April 2012. Beam performance test is now underway.

Materials and Methods: The world’s first system which arranges compact rotating gantry and cyclotron in vertical direction has been developed to save space and cost of facility building. This system enables building space to be a half of that of the conventional type, and it makes PTS easier to be installed in a small area. Though the system becomes compact, its performance has been perfectly kept by using many state-of-the-art technologies. These are multi-purpose nozzle which has function of both wobbling and scanning irradiation,