The first IMRT dosimetry intercomparison of the SGSMP using a thorax phantom with inhomogeneities

H.Schiefer[1], G. Nicolini[2], A. Fogliata[2], W.W. Seelentag[1], and M.K. Fix[3]
[1] Klinik für Radio-Onkologie, Kantonsspital St.Gallen, St.Gallen
[2] Oncology Institute of Southern Switzerland, Medical Physics, Bellinzona
[3] Division of Medical Radiation Physics, Inselspital, Bern University Hospital, and University of Bern
mail: johann.schiefer@kssg.ch

Introduction

An audit performed by an independent external body is a fundamental step in any dosimetry quality assurance program. [1]. An issue often discussed is the ability of the planning systems to take into account inhomogeneities, especially in the thorax region. So, it has been decided to perform a national intercomparison in Switzerland dealing with IMRT in the thorax region.

Material and Methods

The intercomparison has been organized by the team of the Cantonal Hospital of St.Gallen. The thorax phantom 002LFC (CIRS Inc.) has been used. To accommodate the TLDs, a standard slice has been modified with 54 drillings grouped in 7 anatomic regions. The CT scan has been carried out by the institutions themselves. For the planning process, dose constraints for different structures had to be considered. The applied CT dose has been measured with additional TLDs, attached to the phantom surface. Measurements have been done with TLDs, EDR2 films (Kodak) and ionisation chambers (4 positions). Measurements of an additional irradiation with a single field using TLDs and ionisation chamber allowed checking the absolute dosimetry and correcting for systematic errors. The TLD procedure has been described elsewhere [2]. Altogether 23 institutions participated with 24 machines. 30 planning-irradiation combinations have been evaluated. For the planning evaluation, the calculation algorithms have been classified as type a and type b algorithms. In contrast to type a algorithms, type b algorithms are 3D. They are able to treat the electron transport in an approximate way as well as the secondary photon transport in the medium.

Results

Machine output check: The ratio between the measured to the stated dose has been 1.007 ± 0.010 (ion chamber measurement and 1.002 ± 0.014, respectively (TLD measurement).
Planning check: Due to the limited number of participants, it is not possible to issue reliable statements on the properties of the applied calculation algorithms. Nevertheless, there are some trends to observe: Generally, „type b“ algorithms take inhomogeneities better into account than “type a” algorithms. In the lung region of the PTV, the difference of the calculated dose D_c to the measured dose D_m relative to the stated dose $D_{prescribed}$, $(D_m-D_s)/D_{prescribed}$, is -0.4 % instead of -5.5 %. In regions outside the lung tissue type a algorithms show similar satisfying results as type b algorithms. Further results have been presented in [3] and will be published in detail.

Discussion

The results of the intercomparison exceed the expectations. They suggest that cancer patients in Switzerland get a suitable radiation therapy in any of the centres offering this treatment modality. In the future, the IMRT intercomparison will be repeated regularly with modified objectives.

References

[1] Izewska J., Svensson H., Ibbott G.: Worldwide quality assurance networks for radiotherapy dosimetry. International Atomic Energy Agency. Standards and codes of practice in medical radiation dosimetry (2003) 2: pp. 139 – 55
[2] Schiefer H., Seelentag W.W., Stucki G.: Ein nationaler Dosimetrievergleich durch Postversand von TLDs. Proceedings of the SGSMP Scientific meeting in Sion 2001, ISBN 3 906 401 34-0, S. 89 - 94
[3] Schiefer H. and Seelentag W.W. Results of the IMRT dosimetry intercomparison 2008. SGSMP Bulletin Nr. 68 (2009) 1: pp 16– 19. http://www.sgsmp.ch/bullA91.pdf