Dosimetric Verification Needs for Conformal Therapy and IMRT

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Abstract

Traditionally, radiotherapy dose verification has consisted primarily of comparing the dose distribution measured in a water tank (on the central axial slice) versus the dose calculated in a simulated water phantom using the treatment planning system, and checking dose per monitor unit for various treatment fields and clinical situations. In vivo dosimetry using TLDs or diodes has also been used in selected clinical scenarios. However, we are now faced with 1) much more complex treatment delivery, including SMLC (multiple segment) and DMLC (dynamic MLC) delivery of IMRT, 2) treatment plans generated using inverse planning or optimization algorithms and more complicated and sophisticated dose calculation algorithms, 3) more precise target delineation and dose specification requirements, and 4) better knowledge of the uncertainties of patient setup and motion. Although it is crucial to consider these issues when defining the Quality Assurance (QA) program associated with IMRT implementation and use, current QA programs often limit checks to restricted aspects of the process. Numerous technological advances (2-D x-ray imagers, new detectors, innovative data analysis tools) have been applied to these QA issues, but these new tools also are used in limited ways. This presentation will analyze the overall QA requirements for dosimetric verification for complex conformal and IMRT treatments, compare those needs with standard approaches, and then look for more effective ways to approach the QA needs of these treatments, with the goal of improving the overall quality assurance of the entire process.
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