

AbstractID: 3838 Title: Tolerance Levels for Dosimetric IMRT QA Based on Radiobiological Parameters

Purpose: Tolerance levels for dosimetric verification of IMRT plans are usually set at constant values. This QA process is not patient specific. It ignores the potential role of fraction size and treatment site in determining the clinical consequences of an error in dose calculation and/or delivery. The objective of this work is to develop dose tolerance levels for IMRT based on radiobiological parameters.

Method and Materials: The linear quadratic cell survival model which accounts for the effects of both total dose and fraction size was used. A technique was developed to convert dosimetric tolerance levels between treatment schedules while maintaining a constant uncertainty in a radiobiological parameter. Specifically, a constant tolerance level in a radiobiological parameter is set, rather than in calculated/delivered dose. Calculations were performed for different treatment fractionations and α/β ratios mimicking a wide range of clinical situations.

Results: Tumors with low α/β ratio (melanoma, prostate) are more sensitive to errors in total dose. Dosimetric tolerance for such tumors should be approximately 65% of those of other tumors. For such malignances, if a 3% error in calculated/delivered dose is acceptable for treatment of most tumors, this should be reduced to 2% for treatment of these more radiosensitive tumors. In addition, results show that in field late and early responding normal tissues are more sensitive to errors in dose than out of field tissues.

Conclusions: Invariant tolerance levels are appropriate for a wide range of clinical IMRT schemes, especially given current uncertainties in clinical α/β values. Assuming that current dosimetric levels are appropriate for some clinical applications, the appropriate values for all other applications are between 0.5-2 times the currently used values for IMRT QA. In conclusion, tolerance levels for dosimetric QA based on radiobiological parameters provide useful information and may be more appropriate for verifying calculated/delivered dose.