A Monte Carlo Study of Out-Of-Field Doses From Cobalt-60 Teletherapy Units Intended for Historical Correlations of Dose to Normal Tissue


Presentations
SU-C-BRC-1 (Sunday, July 31, 2016) 1:00 PM - 1:55 PM Room: Ballroom C

Purpose: Innovations in radiotherapy treatments, such as dynamic IMRT, VMAT, and SBRT/SRS, result in larger proportions of low-dose regions where normal tissues are exposed to low doses levels. Low doses of radiation have been linked to secondary cancers and cardiac toxicities. The AAPM TG Committee No.158 entitled, ‘Measurements and Calculations of Doses outside the Treatment Volume from External-Beam Radiation Therapy’, has been formed to review the dosimetry of non-target and out-of-field exposures using experimental and computational approaches. Studies on historical patients can provide comprehensive information about secondary effects from out-of-field doses when combined with long-term patient follow-up, thus providing significant insight into projecting future outcomes of patients undergoing modern-day treatments.

Methods: We present a Monte Carlo model of a Theratron-1000 cobalt-60 teletherapy unit, which historically treated patients at the University of Florida, as a means of determining doses located outside the primary beam. Experimental data for a similar Theratron-1000 was obtained at the University of Wisconsin’s ADCL to benchmark the model for out-of-field dosimetry. An Exradin A12 ion chamber and TLD100 chips were used to measure doses in an extended water phantom to 60 cm outside the primary field at 5 and 10 cm depths.

Results: Comparison between simulated and experimental measurements of PDDs and lateral profiles show good agreement for in-field and out-of-field doses. At 10 cm away from the edge of a 6x6, 10x10, and 20x20 cm2 field, relative out-of-field doses were measured in the range of 0.5% to 3% of the dose measured at 5 cm depth along the CAX.

Conclusion: Out-of-field doses can be as high as 90 to 180 cGy assuming historical prescription doses of 30 to 60 Gy and should be considered when correlating late effects with normal tissue dose.