AbstractID: 2807 Title: Clinical Reference Dosimetry of a "Hi-Art II" Helical Tomotherapy Machine

Purpose: To develop a procedure for calibrating “Hi-Art II” helical tomotherapy machines using TG-51 and analyze the uncertainties associated with minor departures from the TG-51 protocol.

Methods and Materials: Physical limitations of the tomotherapy unit (85cm SAD) restrict the user from performing a rigorous TG-51 calibration. The Radiological Physics Center determined the ionization ratio (IR) using a water phantom and Exradin A12 ion chamber for a 40cm x 5cm field (8.9^2 eq.sq.). The IR was converted to $\%dd(10)_x$ using a published relationship between $\%dd(10)_x$ and IR. The beam quality conversion factor, k_Q, was determined, P_{ion} was measured and P_{pol} was assumed to be unity. The ion chamber center electrode was placed at d_{max}, instead of the recommended 10cm depth. The output/min was calculated using TG-51 and verified using a newly designed TLD jig.

Results: The measured IR indicates a beam energy slightly greater than that for a 4 MV x-ray beam. The reference calibration resulted in a dose rate of 882.7 cGy/min at d_{max} for a 40cm x 5cm field at 85cm SAD that was within 1% of the dose rate (890.6 cGy/min) set by the factory where 0.4% of the difference was due to ADCL calibration differences and an un-flattened beam. The TLD/ion-chamber dose ratio was 0.993 (std.dev.= 0.007). An analysis of uncertainties associated with measuring IR and conversion to $\%dd(10)_x$, use of a 40 x 5 cm^2 field instead of 10 x 10 cm^2 and calibration at d_{max} instead of 10 cm results in a possible increased uncertainty of 0.5% in the final reference calibration. We believe this to be negligible.

Conclusion: A procedure was developed to calibrate “Hi-Art II” tomotherapy machines using TG-51 with a minimal increase in the uncertainty of the final calculated dose rate.

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