AbstractID: 5886 Title: Dosimetric validation of Tomotherapy in hetergeneous media

Purpose: Helical Tomotherapy is a relatively new treatment modality that is being used to treat lesions that lie within and near low-density organs. Accurate dose calculations are critical to the effective use of this modality. This study quantified the Tomotherapy treatment planning system (TPS) convolution-superposition-based dose calculation accuracy in heterogeneous media.

Method and Materials: This evaluation required a custom fabricated dosimetry phantom with lung-equivalent and water-equivalent media. The phantom consisted of an 18X18X18 cm^3 cuboid constructed from slabs of water-equivalent and lung-equivalent materials (LN300 Gammex RMI, Middleton, WI (ρ ~0.3g/cc), and Balsa wood (ρ ~0.1g/cc) and imaged on a CT scanner. Dose measurements were conducted using both film and ionization chambers using the same phantom geometry. Evaluations were conducted using an esophageal treatment plan, delivering 1.8 Gy/fraction, was superimposed onto the phantom CT-datasets and computed the dose distributions using the Tomotherapy treatment planning system. Radiochromic film (EBT, International specialty Products, Wayne, NJ) sheets were inserted between slabs of virtual water and lung equivalent material LN-300. Experiments were repeated with radiographic film (Kodak EDR2, Eastman Kodak, Rochester, NY) with balsa wood. Calibration curves for absolute dosimetry for both types of film were generated from additional film exposures and ion chamber measurements on the Tomotherapy unit. Ionization-chamber measurements were performed to confirm the film dosimetry.

Results: Doses measured inside the water-equivalent plastic were within 2% of the computed doses by the Tomotherapy planning system. Measurements with radiochromic film in LN-300 material verified that the planning system computed the doses within 5%. Similar results were observed with EDR2 film in Balsa wood.

Conclusions: The dose calculation accuracy of TPS was measured to be within 5% in lung material and within 2% in water-equivalent plastic.

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