

**Purpose:** Tissue heterogeneity changes result in a build down/build up of the recoil electron fluence at heterogeneity interfaces. The use of stereotactic radiosurgery beams on small lung lesions can compromise the dose delivery to lesions ranging from 6 mm up through 30 mm in diameter, since the dimensions of the lesions are comparable to the range of the secondary electrons in lung and air. Dose perturbations are evaluated for a range of lesion diameters in lung equivalent phantom material.

**Methods and Materials:** Lesion diameters of 6.4, 12.5, 19.7, and 25.4 mm of unit density were inserted into lung equivalent material. The dose distributions were measured with film densitometry and calculated with the dose calculation engine of the ADAC Pinnacle system. The Pinnacle treatment planning system uses the adaptive convolution superposition algorithm, which rigorously reproduces x-ray beam attenuation, and the electron fluence changes at tissue heterogeneity interfaces.

**Results:** The physical density of the lung equivalent phantom material is  $0.30 \text{ g/cm}^3$  in contrast to water and normal tissue at  $1.0 \text{ g/cm}^3$ . The spherical tumor phantoms were irradiated with beam margins of 0, 7, 10, and 25 mm. Dose volume histogram analysis was performed to develop a DVH surface map of the dose delivery to each lesion as a function of margin size. It was determined that a 7 mm margin for all lesion diameters delivers a minimum tumor dose of 94 % of the prescribed isocenter dose for all lesion diameters. The DVH analysis and film dosimetry were also compared with the dose calculations of the BrainSCAN planning system.

**Conclusion:** These measurements and calculations confirm the clinical feasibility of stereotactic irradiations of lung lesions with minimal compromise of the tumor dose.

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