AbstractID: 1603 Title: Dose perturbation by tissue heterogeneities and comparison with the BrainSCAN treatment planning system calculations

Introduction

BrainSCAN utilizes a pencil beam algorithm and accounts for ray-line tissue heterogeneity attentuations but not the heterogeneity impact on electronic equilibrium. Stereotactic radiosurgery beams dimensions are comparable to the range of the secondary electrons in lung and air. The dose perturbation estimates are presented for small beam irradiation of lesions in the lung and the head and neck.

Methods and Materials

Limitations of the BrainSCAN dose algorithm are estimated by comparison with the direct dosimetry and with treatment plan calculations by the PINNACLE. PINNACLE treatment planning system uses the Adaptive Convolution Superposition algorithm, which accounts for direct x-ray beam attenuation and electronic equilibrium. Dose distribution was calculated in anthropomorphic phantoms and for human treatment plans, both thoracic lesions and head and neck lesions.

Results

The density of a lung tissue is approximately 0.3 g/cm^3, in contrast normal tissue at 1.0 g/cm^{3}and air in the sinus cavity at 0.0013 g/cm^3. The density of lung tissue has a lesser impact on the dose distributions than that of the sinus cavity. Typical dose dimunition to the edge of a thoracic lesion is on the order of 8% with essentially no perturbation dose to the center of a lung lesion. This contrasts with the larger perturbation of dose delivery to lesions adjacent to a sinus cavity where the perturbation for a single beam can be as large as 25%. Again the dose to the lesion center is essentially in agreement with the BrainSCAN treatment planning system predictions.

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