AbstractID: 8289 Title: Validity of Inhomogeneity Correction in Small Felds Used in CyberKnife

Purpose: With simultaneous imaging and tracking target during treatment, CyberKnife has created a niche for the treatment of lung cancer. Dosimetry in small field is challenging that becomes extremely uncertain with low-Z inhomogeneities. This study is undertaken to dosimetrically evaluate the accuracy of CyberKnife treatment planning for lung treatment.
Method and Materials: A lung phantom made out of cork (ρ=0.25 g/cm^3) sheet and solid water was used. Gold fiducial markers were placed on the cork slab at different depths for tracking. Three set of scans (depending on the depth of measurements) were acquired that was used for planning using Multiplan version 2.0.5 of the CyberKnife. For each cone, treatment plans were generated with a single beam (QA mode) to deliver 200 cGy to 100% isodose line to the micro-detector that was chosen as the target. Under image guidance calculated MUs were delivered and the detector readings were converted to dose.
Results: The differences between measured and calculated dose at shallower depths and small cones were significantly large (-120%). The differences reduced as the cone size increased. At deeper depths the measured and calculated dose agreed relatively better. However the disagreement was still large (20%). For all depths, the disagreements between measured and calculated dose plateau for cones >2 cm. Such large differences indicate that advance Monte Carlo based algorithm for inhomogeneity correction should be incorporated in treatment planning.
Conclusion: It is concluded that Multiplan does not provide accurate dose calculation with inhomogeneities. The range of errors are from -120% to +20% in small fields. Additional investigation is needed to validate these finding with different detectors with known perturbations such as film, and diodes. This study provides a window in the problem of the dosimetry in small fields and has significant clinical implication for the treatment of lung cancer with CyberKnife.