

AbstractID: 8444 Title: Respiratory-gated Radiation Therapy for the Liver: A 5-patient Study

Purpose: To investigate the feasibility and accuracy of using a combination of internal and external fiducials for respiratory-gated image-guided radiotherapy of liver tumors with commercially-available systems.

Method and Materials: Five patients were enrolled in the study. Patients were treated on either a 2100EX or Trilogy linear accelerator (Varian Medical Systems). Respiration was tracked and the beam was gated using the RPM system (Varian). Radio-opaque fiducials implanted adjacent to the liver tumor were used for daily online set-up using non-simultaneous orthogonal electronic portal or kV images and ISOLOC software (MedTec). The threshold for couch shifts was 2 mm, while the respiratory gate was set at 1 mm. The accuracy of respiratory-gated treatment using an external fiducial was verified offline using cine mode images acquired during treatment.

Results: The range of tumor motion was between 8.0 mm and 44.3 mm in the supero-inferior (SI) direction, which is the dominant direction of motion due to respiration. For all patients, interfractional variation, a measure of set-up uncertainty, was 0.3 ± 2.3 mm (1σ) in the SI direction. The intrafractional variation, a measure of the precision of gating, was found to be ± 1.0 mm (1σ). The average duty cycle varied between 18% and 28%.

Conclusion: Respiratory gating with either EPID or kV imaging using readily available and affordable infrastructural elements can provide accurate, reproducible, and verifiable means to deliver precision radiotherapy to liver tumors. Daily analysis of the cine images is an effective way to verify that the treatment was delivered as planned and we strongly recommended it.