AbstractID: 13933 Title: Beam's-eye-view MV fluoroscopy during SBRT for tumor tracking and treatment verification

Purpose The radiotherapy treatment beam captured in megavoltage fluoroscopy (MVF) mode contains a record of tumor motion during treatment. This study's objectives were to use MVF to: 1) verify whether a tumor remains fully within the treatment beam; and 2) assess the reduction of tumor motion during the beam-on period by respiratory gating. **Method and Materials** Electronic portal imaging was used to capture beam's-eye-view fluoroscopic movies of target movement within the treatment beam during SBRT. Dose rate was 300 MU/min; no imaging dose beyond the treatment dose was required. Images were captured at 7-13 frames/sec. Three lung cancer and 2 liver cancer patients were studied over 5 fractions each; 2 were respiratory gated. For liver tumors, implanted gold fiducial markers and surgical clips provided surrogates of tumor motion. Custom image analysis and tracking software was written using MeVisLab/VTK/ITK. Deformable registration between image frames was used to warp tumor contours and compute the tumor center of mass and tumor borders relative to the ITV/PTV as a function of time. **Results** MVF tumor tracking yielded tumor range-of-motion measurements of 4-10 mm in the lung cancer patients, and liver fiducial tracking yielded motion measurements of 14mm and 11mm in the liver cancer patients. Large tumor motions due to infrequent large inspirations were reduced by respiratory gating with 75% inspiration threshold. Ungated motion was measured from pre-treatment cone-beam projection data. Gating reduced the tumor range of motion from 14mm to 9mm for the lung patient and from 17mm to 14mm for liver patient. **Conclusions** Motion measured via MV fluoroscopy during SBRT can be used to verify whether planned margins are adequate and evaluate the effectiveness of respiratory gating. Future work towards real-time processing could provide control signals for gating or dynamic multi-leaf collimators.