AbstractID: 1064 Title: Four Dimensional Tomotherapy

Tomotherapy is potentially a useful tool in NSCLC dose escalation. A new motion mitigation technique was developed to compensate intra-fraction respiratory motion.

In this technique, the correlation between breathing phase and delivery phase is set prior to treatment planning. During treatment, the correlation is preserved by instructing the patient to breathe following a visually displayed breathing guide that is derived from the patient's own breathing cycles. A dynamic lung image sequence, acquired by a 4D CT scan, is used for treatment planning. One of the breathing phases is selected as the primary phase. Displacement vector maps of the lung at other phases are obtained by deformable image registration. Beamlet dose distributions are calculated by selecting the CT images at the corresponding breathing phase according to the preset breathing-delivery phase correlation and then mapped back to the primary phase with the knowledge of the displacement vector field at that phase. Motion incorporated treatment plan optimization using the deformed beamlets gives an optimal plan for a target deforms in a pattern predicted by the breathing guide.

A combined laser-spirometry system was developed to provide accurate prediction of the target position. The motion margin was reduced by a factor of about 5 with synchronized breathing for the test patients. The effects of residual motion from tracking errors were also calculated. Similarly high dose conformality was observed on a mobile target as compared with static delivery.

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