AbstractID: 7419 Title: Modeling of Tomotherapy delivery to predict dose errors due to tumor motion in lung

Purpose

To develop an approximate model to the convolution technique simulations to predict tomotherapy dose delivery errors in the presence of respiratory motion using one-dimensional breathing motion and unmodulated delivery models. Catalog the "space" of safe treatments as defined by the model.

Method

The patient breathing motion data, acquired as a function of tidal volume (ml) is converted to distance (mm) with time. Moving-average of the motion data is determined where the average is taken over the time span of time taken for a point at the edge of the field to cross other edge with constant couch velocity. The time axis is converted into distance by multiplying by the couch speed. Moving difference of the moving-average of the motion data is determined over the same time span to determine the drift of the point during the treatment. The dose error ratio is then found by dividing the drift by the field size.

Results

Dose error ratio for combination of delivery parameters (couch speed, field size) and breathing magnitude for 42 clinical patient motions was studied. The dose error prediction by this approximate model is compared with convolution technique simulation is presented for different delivery scenarios for two different field size.

Conclusion

The results show the proposed approximate model predicts the dose errors ratio reasonably close to convolution dose error prediction approach for clinically used tomotherapy delivery parameters. The approximate prediction model breaks down for extreme conditions of breathing magnitude and couch velocity. It will allow the treatment planner to determine if Tomotherapy treatment delivery is appropriate for specific patients whose tumors move due to breathing.