

AbstractID: 10892 Title: Is average CT a good estimate of mid-ventilation position of surrounding normal structures for proton therapy treatment planning of lung tumors?

Purpose: Mid-ventilation CT has been used as the reference data set for proton therapy treatment planning. Our aim was to determine if average CT provides an accurate representation of mid-ventilation position of surrounding normal structures for proton therapy of lung tumors.

Methods and Materials: 4DCT scans were acquired for 9 patients with lung tumors for the purpose of proton therapy treatment planning. Maximum (MIP) and average (AVGIP) intensity projection CT datasets were then derived from the 4DCT. Total lung volumes and diaphragm apex positions were delineated on each of the 10 phases of the 4D CT and the average CT. A representative external marker position for each phase of the 4D CT was also determined. Correlations between diaphragm apex position, lung volumes and external marker position were studied. Lung volumes obtained from average CT were compared to those obtained from a mid-ventilation (30% phase of the 4D CT) CT data set.

Results: Eight of nine patients exhibited a correlation greater than 0.9 between the lung volume and external respiratory motion. One patient with an erratic external respiratory trace had a correlation of 0.63. The correlation between lung volume and internal respiratory (diaphragm) motion was greater than 0.85 for all patients observed. Total lung volume determined from the mid-ventilation (30% phase) CT differed from the average CT by > 5% in only 2 out of 9 cases (max difference = 13.5%).

Conclusions: Total lung volume is strongly correlated to both external and internal (diaphragm) respiratory motion. The average CT provides a suitable representation of mid-ventilation position of surrounding normal structures for thoracic proton therapy treatment planning.