

Purpose:

To evaluate the clinical efficacy of 6D Robotic couch-top in CBCT image-guided stereotactic body radiotherapy (SBRT) for lung cancer.

Methods:

A total 94 analyzable setup cases for Lung SBRT using 6D robotic couch-top were evaluated. The 6D robotic couch-top, furnished by Protura (via Civco Medical Solutions™), can be mounted to the table pedestal of the Varian's TX accelerator. In addition to the original 4D corrections (3 linear motions and Yaw) offered by the Varian table pedestal, the 6D robotic apparatus allows two additional freedoms - Pitch and Roll, which were investigated in this study. During setup, the patient anatomy from planning CT was first aligned to the kV-CBCT in Varian's 4DTC 3D matching program. The 6D movements were then executed from the treatment console.

Results:

Concerning the values of Pitch and Roll corrections in the 94 setups using the 6D robotics, the mean absolute values of both adjustments were 0.86 ± 0.33 degree and 0.61 ± 0.31 degree respectively ($p = 0.007$). Greater than 0.5 degree angular corrections were observed in 69.1% cases for Pitch and in 51.1% cases for Roll, collectively accounting for 90.4% cases. Corrections for one degree or more in either Pitch or Roll consisted 51.1% of cases. However, the average raw adjustments in those were 0.07 ± 1.03 degree and -0.11 ± 0.82 degree respectively.

Conclusions:

Comprehensive correction of high precision alignment for kV-CBCT imaging guided lung cancer SBRT requires adjustments in all six dimensions, including unconventional Pitch and Roll rotations. About 51% of patients require at least one degree corrections in either Pitch or Roll. Less than 10% of cases Pitch or Roll correction were insignificant or smaller than 0.5 degree. Relative to the manual corrections, the automated 6D robotic process increased the efficiency of alignment when Pitch and Roll corrections were warranted.