

Purpose:

To analyze the variation in patient setup and anatomical changes for five different anatomical sites observed in Helical TomoTherapy (HT).

Methods:

52 patients treated for five anatomical sites [brain (10), head-neck (13), Lung (10), abdomen (9) and pelvis (10)] using a HT system were analyzed. Brain, head and neck patients were immobilized with thermoplastic orfit while Lung, abdomen and pelvis patients were immobilized with body fix. Prior to the treatment, three external fiducials per patient were used for setup, which consisted of skin tattoos for prostate and lung patients. There was a marking on mask for head-neck and brain patients. Daily megavoltage computed tomography (MVCT) images were acquired prior to each treatment and were fused with the planning Kilovoltage Computed Tomography (KVCT) reference image to determine the daily setup errors and deformation. The setup errors were corrected before treatment and were used, along with the organ motions, to determine the planning target volume (PTV) margins.

Results:

Mean lateral, longitudinal and vertical shift was found more for Pelvis (1 mm), Abdomen (3.34 mm) and brain (6 mm) respectively. Results of setup error analysis are largely influenced by restricting specific degrees of freedom during image registration. If a yaw and pitch rotations exist during fusion, this will increase the lateral shift correction. If a pitch offset exist, the restriction will increase the vertical and longitudinal shift correction. The results are analyzed by restricting pitch and yaw and corrections are made for roll only.

Conclusions:

The setup errors are site specific and statistically significant. The data presented in this work might be useful in developing advanced radiotherapy technique. These interfractional variations if not adequately accounted for, can result in the delivery of suboptimal dose distribution. HT system used in this study, have capability of quantifying and addressing these variations.