

AbstractID: 3438 Title: Use of CT-simulation tools located on the CT scanner for localization guidance in extracranial stereotactic radiotherapy: A Feasibility Study

Purpose: To quantify the accuracy of CT-simulation localization tools located on the CT-scanner control console for guidance in extracranial stereotactic radiotherapy (ESRT).

Method and Materials: ESRT applies stereotactic treatment principles to irradiate extracranial tumors in few fractions (typically 2-6) with high dose/fraction. To accomplish this, an anatomic reference coordinate system is replaced by an external stereotactic coordinate system and improved patient immobilization methods are also used. Because the patient is scanned prior to each treatment while in the immobilization device, it may be possible to use a low-sag (<1mm at 250lbs) CT couch and CT-simulation tools in place of the stereotactic coordinate system. With adequate immobilization, use of the CT-simulation tools may allow implementation of this technique at institutions where a stereotactic frame and specialized ESRT software are not available.

Four ESRT patients, for a total of twelve treatment fractions, were scanned in a body frame on a CT-simulator equipped with CT-simulation localization tools prior to each treatment. Treatment isocenter coordinates were determined based on target volumes contoured by the physician using the stereotactic frame and specialized ESRT software. A second set of treatment coordinates was determined based on the same contours using the CT-simulation software. The two sets of coordinates were compared to quantify the accuracy of CT-simulation method.

Results: The maximum, mean, and standard deviations between the CT-simulation and stereotactic coordinates for the twelve treatment fractions in X (left/right), Y (anterior/posterior), and Z (cranio/caudal) directions in millimeters were ($X_{\max}=1.1$, $X_{\text{mean}}=0.5$, $X_{\text{SD}}=0.4$), ($Y_{\max}=1.2$, $Y_{\text{mean}}=0.3$, $Y_{\text{SD}}=0.3$), ($Z_{\max}=2.5$, $Z_{\text{mean}}=1.1$, $Z_{\text{SD}}=0.8$). CT study voxel dimensions in X, Y, and Z directions were 0.94mm, 0.94mm, and 3.0mm.

Conclusions: The excellent agreement between the CT-simulation and stereotactic coordinates indicates that CT-simulation tools with appropriate immobilization can be used for target localization or independent verification in ESRT.