

Purpose: To assess the inter-fractional set-up uncertainty of the Body Pro-Lok™ System used in combination with the cone beam kVCT (CBCT) onboard imaging of the Novalis Tx™ during hypo-fractionated liver radiotherapy.

Methods: Thirty-two patients (n=32) treated with 3 to 10 fractions were prospectively analyzed. The Body Pro-Lok™ system was used in both CT simulation and during patient treatment setup. Patients were immobilized with a vacuum cushion placed posteriorly over the thoracic region, an abdominal compression plate, and a knee and foot sponge. Pretreatment CBCT scans of the Novalis Tx™ unit were fused with the planning kVCT prior to delivery of each fraction to determine the inter-fractional set-up error. A total of 229 shifts were analyzed to assess the inter-fractional set-up accuracy.

Results: Results showed that the mean inter-fractional set-up errors and standard deviations were $0.1 \pm 4.5\text{mm}$, $-1.3 \pm 4.3\text{mm}$, and $0.5 \pm 3.6\text{mm}$ for lateral (IEC-X), longitudinal (IEC-Y), and vertical (IEC-Z) variations, respectively. Maximum motion was 14.0, 15.0 and 17.0mm in the lateral, longitudinal, and vertical direction, respectively. When all three translational coordinates were analyzed, a mean composite displacement vector of $4.8 \pm 2.1\text{mm}$ (range: 1.7-9.4mm) was obtained for all patients. Additionally, no differences were noted in setup accuracy between the first and second fractions (mean vector displacement 5.7 vs. 5.9mm, p=0.49) and between the first and last fraction (mean vector displacement 5.7 vs. 6.7mm, p=0.24).

Conclusions: Based on the findings, image-guided hypo-fractionated radiotherapy to the liver using the Body Pro-Lok™ system in conjunction with the CBCT of Novalis Tx™ is capable of minimizing inter-fractional set-up error.