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Comparison of Image Guided Radiotherapy Technologies: Tomotherapy, Varian Trilogy and Elekta Synergy.

Purpose:

Three different Image Guided Radiotherapy (IGRT) delivery systems were evaluated for CT Dose Index (CTDI) , image quality and accuracy of CT number with electron density.

Methods & Materials:

- a) We evaluated the CTDI using the CIRS CT dose phantom.
- b) We investigated the relationship of CT number of the Cone Beam/MVCT scans with the electron density using COM-TOM CT phantom
- c) We investigated the image quality by using Catphan 500 phantom

Results:

The CTDI for Elekta ranged from of a maximum 3.42 cGy for prostate to 0.2 cGy for Head & Neck treatment. For the Varian, CTDI dose was a function of the bow-tie filter used and ranged from 4.15 cGy for body phantom to 8.3 cGy in the head phantom. For the tomotherapy system the CTDI is a function of the pitch and ranged from a maximum of 1.76 cGy in the body phantom to 2.47 cGy in the Head Phantom.

The CT number to electron density were similar and linear for the Tomotherapy and conventional multislice CT scanners. For the Elekta and Varian the CT number from the cone beam CT were not linear and there is a variation of CT number because of changes in X-ray scatter from the cone beam geometry

We report quantitatively low contrast resolution, high contrast resolution, noise and uniformity.

Conclusion:

There is large variation in imaging dose between the IGRT delivery systems.

The CT number to ED was linear for tomotherapy system and as such can be used for dose recomputation. For the Elekta and Varian one has to characterize the non linearities carefully before attempting to use the cone beam CT data for dose recomputation.

All three delivery systems provide sufficient contrast resolution for soft tissue visualization.