The advantage of deep-inspiration breath-hold and cone-beam CT based soft-tissue registration for locally advanced lung cancer radiotherapy - DTU Orbit (18/11/2019)

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Background and purpose: Three cone-beam computed tomography (CBCT) registration strategies combined with deep-inspiration breath-hold (DIBH) and free-breathing (FB) were explored, in terms of obtaining the smallest planning target volume (PTV).

Material and methods: CBCT images were acquired pre- and post-treatment in FB and DIBH, for 17 locally advanced lung cancer patients. Bony registration on the spine, and soft-tissue registrations on the primary gross tumor volume (GTV-T) and GTV-Total, including malignant lymph nodes (GTV-N), were retrospectively analyzed. Setup-margins and resulting PTVs were calculated. Results: For the spine, the smallest residual misalignments were observed in FB, independently of registration method. For GTV-T and GTV-N, soft-tissue registrations were superior to bony registration, independently of FB or DIBH. Compared to FB, PTV-Totals were during DIBH reduced by 13% and 8% for the soft-tissue and bony registrations, respectively. If intra-fractional motion was included, the corresponding gain of DIBH was reduced to 9% and 7%, respectively. Superiority of DIBH was mainly due to larger clinical target volumes in FB.

Conclusions: Despite larger setup uncertainties compared to FB, DIBH resulted in smaller PTV-Totals for all registration methods. Soft-tissue registrations were superior to bony registration, independently of FB and DIBH. During DIBH, undesirable arching of the back was identified. Daily CBCT pre-treatment target verification is advised.

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