Lung cancer

"Slow" CT scan for incorporating lung tumor mobility in radiotherapy planning

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Introduction/objective. Assessment of the use of planning CTs with slow revolution (4s/slice) that captures tumor movement in comparison to "fast" CT in the procedure of radiotherapy planning for lung cancer patients. Additionally, we evaluate the impact on CTV-PTV total margin.

Methods. A total of 13 patients treated for NSCLC Stage I have been included. Each patient was scanned with slow CT and a fast CT (slice thickness 2.5 mm) during free breathing. CTVs were contoured in both CTs. The Internal Target Volume (ITV) was generated as the Boolean union of CTV-fast and CTV-slow. 3D displacement vectors of the individual CTV, related to the ITV from two scan were obtained by comparing the volumes as seen in orthogonals beam’s eye beam projections. Systematic and random setup errors were evaluated by comparing orthogonal portal visions to the corresponding DRRs, and margins were calculated using van Herk’s formula.

Results. In 11/13 patients the mean CTV captured by slow-CT were larger than those captured by fast-CT scan. The mean ratio between the slow CTV and the ITV was 0.80 ± 0.9 vs. 0.73 ± 0.18 for fast CTV. The maximum margins in x, y and z axes which were needed to ensure coverage the ITV when using a fast CT were (mm, 1SD): x₁ 0.46 ± 0.29, x₂ 0.24 ± 0.16, y₁ 0.33 ± 0.31, y₂ 0.18 ± 0.2, z₁ 0.3 ± 0.3, z₂ 0.34 ± 0.27, showing an important individual tumor movement variability. Systematic random setup errors resulted (mm): LAT = 2.0 ± 2.7; VRT = 1.3 ± 1.5 and LONG = 1.5 ± 1.8, resulting in the following setup margins (mm): LAT = 5.4; VRT = 3.3 and LONG = 3.9 mm.

Conclusions. Individualized assessment of tumor mobility is needed and is possible when CTV derived from single slow scan is used for RT planning. The use of slow planning CT allows the reduction of margins in external beam treatment planning.

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Analysis of trachea as surrogate marker for delivering 3D lung radiotherapy

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Purpose. To evaluate the suitability of the trachea contours for patient set-up verification in patients with lung cancer.

Methods and materials. A total of 56 lung cancer patients were included in this study. For all patients a CT scan were acquired and delineation of the target volumes were performed and just in 31 patients the trachea were drawn and planned using the treatment planning system (TPS Eclipse-Aria, Varian Inc.). Setup variations were determined in both groups with and without contoured trachea. The position of the trachea in the digitally reconstructed radiograph (DRR) was compared to the average position of the tracheal air column in the electronic porta images (EFIs) at initial set-up.

Results. Analysis of patient setup errors (mm) ± 1 standard deviations (1 SD) for anterior-posterior (AP), cranio-caudal (CC) and left-right (LR) were 1.8 ± 3.9, 0.4 ± 2.6 and 0.6 ± 3.0 in the trachea contoured compared to 0.6 ± 2.5, −1.7 ± 3.6 and 0.16 ± 2.8 in the no trachea contoured. The SD of the setup errors derived from both the contoured and no contoured trachea groups were not found to be significantly different.

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