Abstract ID: 18317    Title: Comparative Evaluation of Respiratory Motion-Corrected Cone-Beam CT Images Derived From Treatment-Day Vs. Simulation-Day Respiration-Correlated CT Scans

Purpose: Respiration-induced motion artifacts in cone-beam CT (CBCT) can be corrected using a model of patient motion obtained from respiration-correlated CT (RCCT). This approach assumes that respiration-induced organ deformations at simulation, when RCCT scans are normally acquired, are still valid at treatment. The purpose of this study is to compare lung tumor image quality in motion-corrected CBCT images derived from treatment-day RCCT(tx) to simulation-day RCCT(sim) patient images.

Methods: In an IRB-approved study, lung cancer patients receive an RCCT at simulation, and an RCCT, gated CBCT and 1-minute CBCT at one treatment session. CBCT projections from the 1-minute scan are sorted according to breathing amplitude from an external monitor and reconstructed and warped to obtain a motion-corrected MC-CBCT at end expiration. Motion correction uses a model adapted from either RCCT(tx) or RCCT(sim), thus obtaining MC-CBCT(tx) and MC-CBCT(sim) images respectively. A gated CBCT, in which gantry rotation and projection acquisition occur within a gate at end expiration, serves as ground truth for comparison. Quality of MC-CBCT images is evaluated from tumor-to-background contrast ratio (TBCR) values measured by delineating the tumor and annular volume around it on the gated CBCT then transferring the contours and aligning them to each MC-CBCT.

Results: TBCR is found to be lower in MC-CBCT(sim) images, relative to MC-CBCT(tx), in four out of five patients with mean 21% reduction in a range 9-39%. In the remaining case, where there was no change in TBCR, tumor motion observed in the RCCT was small (2mm). Tumor motion extent relative to diaphragm is observed to change between RCCT(tx) and RCCT(sim) scans.

Conclusions: Preliminary results indicate that deformation patterns in lung do change between simulation and treatment. Such variations may reduce the validity of using simulation data for motion-corrected CBCT at treatment. The findings require confirmation with larger numbers of patients.

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