

AbstractID: 10828 Title: Can Lung Dose-volume Criteria Derived from 3D Era Be Safely Used for 4D Planning?

Purpose: Total lung volume (TLV) varies during respiration. The TLV dose-volume criteria currently used for treatment planning of lung irradiation are derived based on 3DCT. We investigate the variations of TLV and lung dose during respiration and determine if the current TLV dose-volume criteria can be safely used for planning respiratory-correlated treatment. **Methods and Materials:** The data of 4DCT and 3DCT acquired with free breathing during the same session for nine patients were analyzed. Each 4DCT set consisted of 10 phases. TLVs delineated using an automatic tool on 3DCT, 4DCT individual phases, and the average intensity projection (Ave-IP) were compared. For each patient, a representative plan designed based on the 3DCT was applied to each phase of the 4DCT and the Ave-IP CT. The dose volume parameters of V_{20} (volume receiving 20 Gy), V_{10} , V_5 , and mean lung dose (MLD) from the above 12 plans for each case were compared. **Results:** TVL varied by 20% during respiration as compared with the TLV from 3DCT or Ave-IP. On average, the TLV at 30% (mid-exhalation) or 70% (mid-inhalation) phases agreed within 2% with the TLV from 3DCTs for the nine cases studied. The average TLV from the Ave-IP CTs was consistent within 2% with the average TLV of 20% or 80% phase. For all cases studied, the average MLD, V_{20} , and V_{10} varied by 2% while the average V_5 varied by 3% during respiration. The maximum variation for these dose-volume parameters was 7%. **Conclusion:** TLVs for 20%- or 30%-phase, Ave-IP, and 3DCT are comparable, and the 20%-30% phase CT may be used as the base CT for non-gated ITV-based treatment planning. For treatment planning of a gated delivery at maximum exhalation or inhalation, a margin of 3% should be considered when using the current lung dose-volume criteria.