

Purpose: There is no clear consensus as to how to define normal lung volume; clinicians subtract either PTV or GTV from total lung volume. This study quantified the dosimetric and biological differences between these definitions for radiotherapy planning with and without inhomogeneity corrections.

Materials and Methods: In this study, ten lung cancer patients with prescription doses (PD) 50–70 Gy (average 62 Gy) were evaluated. Dosimetric plans were generated using XIO-CMS software. Complex (4–6 fields) 3D conformal radiotherapy plans with and without tissue heterogeneity corrections were compared. NTCPs were computed for three scenarios: respiratory pneumonitis (RP) endpoint of SWOG grade ≥ 2 RP (TD₅₀=30.8 Gy, n=0.99, m=0.37; NTCP₁), SWOG ≥ 1 RP (TD₅₀=28 Gy, n=0.87, m=0.18; NTCP₂), and radiographic & symptomatic pneumonitis (TD₅₀=21.9 Gy, n=0.8, m=0.37; NTCP₃). Normal lung or NTCP was defined in two ways: [(left lung + right lung) – PTV], and [(left lung + right lung) – GTV]. Volume (V_x) of normal lung receiving 5 Gy (V₅), 13 Gy (V₁₃), 20 Gy (V₂₀) and 30 Gy (V₃₀) were also investigated.

Results: For inhomogeneity non-corrected plans: average PTV dose coverage was 97% (92.1–101.7%) of PD; with –PTV definition, average V₅=41.3% (24.3–70.2%), V₁₃=26.4% (15.9–36.8%), V₂₀=22.2% (13.1–32.4%), V₃₀=18.3% (10.9–27.8%), NTCP₁=6.5% (2–16.5%), NTCP₂=1.3% (0.01–8.6%), NTCP₃=23.3% (6.7–51.2%); and with –GTV definition, average V₅=43.2% (25.6–71.3%), V₁₃=28.7% (17.9–39.2%), V₂₀=24.7% (15.1–34.9%), V₃₀=21% (13–30.5%), NTCP₁=8.8% (2.6–20.7%), NTCP₂=3.5% (0.02–16.3%), NTCP₃=31% (9.7–60.8%). For inhomogeneity corrected plans: average PTV dose coverage was 99.6% (93.1–107.6%); with –PTV definition, average V₅=43.7% (25.3–74%), V₁₃=27.9% (17–42.7%), V₂₀=23.2% (14.7–33.7%) and V₃₀=19% (11.2–28.5%), NTCP₁=7.8% (2.2–19.9%), NTCP₂=2.5% (0.01–14.1%), NTCP₃=27.9% (7.4–58.2%); and with –GTV definition, average V₅=45.5% (26.5–75%), V₁₃=30.2% (19.5–44.5%), V₂₀=25.7% (16.1–36.1%), V₃₀=21.7% (13.6–31.1%), NTCP₁=10.7% (2.8–24.9%), NTCP₂=6% (0.03–24.9%), NTCP₃=36.5% (10.7–67.8%).

Discussion and Conclusions: Results revealed that for heterogeneity non-corrected plans, relative increase (with respect to –PTV definition) of V_xs were 4.7%, 8.9%, 11.3%, 14.7%, and NTCPs were 32.6%, 193.4%, 32.8%; and similar increases were observed for heterogeneity corrected plans.