Purpose:

NTCP analysis was performed with Lyman model to study the dose tolerance limits for radiation-induced pneumonitis (RP) in hypofractionated SBRT. Since SBRT is increasingly being applied for the treatment of large and central tumors, it is important from a clinical point of view to determine the dose tolerance limits for specific risk of toxicity.

Methods:

Eighteen consecutive patients who were treated using volumetric modulated arc therapy (RapidArc) for lung tumors exceeding 80cc were assessed. The evaluation of toxicity was scored using Common Toxicity Criteria AE4.0. Median follow-up time was 12.8 months. Clinical outcomes have been published, and we performed an NTCP analysis to determine the complication rate in relation to statistical dose tolerance limits. The dose volume histogram (DVH) reduction techniques of the total lung V20Gy, V15Gy, V10Gy, V5Gy and mean lung dose (MLD) were each analyzed, as well as the ipsilateral lung V5Gy and the contralateral lung V5Gy. The framework of the Lyman Model was used except that each DVH reduction method was analyzed independently instead of using the power-law relationship for volume dependence. Model parameters were fitted using the Maximum Likelihood technique.

Results:

RP was reported in 5 patients (CTC Grade 2 in 3, and Grade 3 in 2). Total lung V5Gy and contralateral lung V5Gy were the best predictors of RP (p < 0.0001 for both). For V5Gy, the 10% risk level for Grade 2-3 RP was 28.4% for total lung and 21.6% for contralateral lung.

Conclusions:

Analysis of RP endpoints has identified total lung V5Gy and contralateral lung V5Gy as the best predictors of RP following RapidArc. These findings are based on limited clinical data, and longer follow-up in larger patient cohorts is required in order to determine more accurate dose tolerance limits.

Funding Support, Disclosures, and Conflict of Interest:

Dr. Grimm developed the DVH Evaluator, described at www.DiversiLabs.com and distributed by www.LifeLineSoftware.com. The analysis presented here is part of that software.
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