

Abstract 2447 – Table 1: Definitions of in-field progression

Anatomic Regions included for In-Field Definitions	# of Eligible Studies (n=60)
Not defined	42
Within radiation volume	11
Within radiation volume or margin	1
Primary tumor/site	2
Includes lymph nodes	2
Thorax	1
Poorly specified	1

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2448**Identification of Dosimetric and Clinical Predictors for Post-Treatment Pulmonary Hospitalizations in NSCLC**

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Purpose/Objective(s): Pulmonary events following radiation therapy (RT) for non-small cell lung cancer (NSCLC) can lead to morbidity and negatively affect outcomes. This study evaluates the predictive value of dose-volume parameters (mean lung dose [MLD], V5–V60) and clinical factors for post-treatment pulmonary hospitalizations. We seek to improve risk stratification and develop more comprehensive clinical decision-making tools.

Materials/Methods: Data were analyzed from a prospective statewide quality consortium. Eligible patients (2018–2024) included those with stage I–III NSCLC treated with definitive RT with available dosimetric data. Patients receiving surgery were excluded. Pulmonary hospitalizations were classified as pneumonitis, COPD, pneumonia, or other respiratory complications based on clinical diagnosis, with multiple classifications allowed for overlapping conditions. EQD2 dose distributions were calculated ($\alpha/\beta = 3$). Multivariable Cox proportional hazards models were used to identify predictors of hospitalization, and cumulative incidence estimates were calculated, accounting for competing risks of death. Variables were selected using a stepwise procedure, and interactions were tested for significance.

Results: Of 1407 patients, 310(19%) experienced a lung-related hospitalization. Median follow-up was 14 months. Pneumonitis, pneumonia, and COPD-related hospitalizations occurred in 34(2%), 156(10%), and 135 (8%) patients, respectively. The 24-month cumulative incidence of pneumonitis, pneumonia, and COPD-related hospitalizations was 2.7%, 10.6%, and 12.2%, respectively. The cumulative incidence of any lung-related hospitalization was 24.4%. MLD was the strongest predictor of pneumonitis (HR = 1.24 per 1 Gy, $p < 0.01$) and overall lung-related hospitalizations (HR = 1.04 per 1 Gy, $p < 0.01$). The estimated 24-month cumulative incidence of lung-related hospitalization increased from 18% at MLD = 0 Gy to 35% at MLD = 20 Gy. Lung dosimetric factors are seen in table below. ECOG performance status (2 vs. 0/1), pre-existing COPD, and supplemental oxygen use were independently associated with increased hospitalization risk.

Conclusion: This analysis confirms that MLD and dose-volume metrics are key predictors of pulmonary hospitalizations in NSCLC. Clinical factors further refine risk assessment. Integrating dosimetric and clinical data can improve risk stratification and guide personalized treatment decisions.

Abstract 2448 - Table 1: Lung dosimetric factors and corresponding 24 month pulmonary hospitalization HR

Dose-Volume Parameter	HR (95% CI)	χ^2 value
MLD	1.037 (1.009-1.066)	0.0091
V5	1.007 (1.001-1.014)	0.0211
V10	1.009 (1.001-1.018)	0.0331
V20	1.018 (1.003-1.032)	0.0147
V30	1.023 (1.004-1.043)	0.0191
V40	1.033 (1.006-1.060)	0.0143
V50	1.046 (1.010-1.084)	0.0109
V60	1.065 (1.011-1.122)	0.0180

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2449**Effects of Liberalizing Lung V5 on Intermediate and High-Dose Exposure: Insights from Lung and Esophageal Cases Treated with Photons**

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Purpose/Objective(s): Balancing effective tumor dose delivery while minimizing cardiopulmonary toxicity remains a key challenge in thoracic radiotherapy. Lung V5 (volume receiving ≥ 5 Gy) is a traditionally used constraint to limit low-dose lung exposure, but its clinical significance remains uncertain as outcome data do not support its benefit. In this *in silico* study, we hypothesized that relaxing the lung V5 would improve organ-at-risk (OAR) sparing, particularly for cardiac and intermediate-dose lung metrics.

Materials/Methods: Five representative cases with centrally-located targets suitable for full-arc volumetric modulated arc therapy (VMAT) were selected: three esophageal cases (two distal tumors 5cm and 15cm in length and one upper tumor) treated to 45 Gy including elective nodal coverage and a simultaneous integrated boost to 50 Gy, and two lung cases (right-sided primary with N2 and left-sided primary with N3) treated to 60 Gy. Three optimization scenarios were deployed: **V5-Standard** (V5 <50% for esophagus, V5 <60% for lung; Plan A), **V5-Intermediate** (V5 <75% for both; Plan B), and **V5-Agnostic** (no V5 constraint; Plan C). Dose metrics were collected for