



# PHYSICS

## Thoracic dose patterns associated with radiation induced lymphopenia in patients treated for NSCLC

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### *What was your motivation for initiating this study?*

Radiation-induced lymphopenia (RIL) is a common side effect of radiotherapy that may compromise the efficacy of the treatment and patients' survival. Multiple immune structures at risk may be involved in the development of RIL; consequently, voxel-based analysis would be helpful to go beyond the traditional organ-based approach through blind identification of these anatomical regions. In addition, the availability of heterogeneous proton and photon-dose distribution data for this analysis would enable us to shed light on the response pattern underpinnings of RIL, which may be obscured by the relative homogeneity of a single modality.

### *What is the most important finding of your study?*

Our approach enabled us to reveal a strong correlation between RIL and the dose that was delivered to the primary lymphoid organs (thymus and bone marrow in the vertebrae, right ribs, and sternum), heart and right lung. These findings confirm a radiobiological model in which the injury that is caused by alterations in lymphoid and haematopoietic irradiated tissues affects the mechanisms of lymphocyte replenishment. In addition, they highlight the role in RIL development in the depletion of peripheral blood lymphocytes that traverse the radiation field in the blood circulation.

### *What are the implications of this research?*

The adopted approach enabled the elucidation of the dynamics of the RIL development, which laid the groundwork for a knowledge-based optimisation of RIL mitigation strategies and the application of effective individualised radiotherapy. Indeed, the preservation of lymphocytes through mitigation of radiation damage to lymphoid organs and circulating lymphocytes is pivotal to the advancement of radiotherapy as well as to enhance the effectiveness of its combination with adjuvant immunotherapy for lung cancer.



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