

## **Abstract**

Radiotherapy is one of the main modalities of cancer treatment where ionizing radiation is applied to treat cancer. When planning radiotherapy, it is essential to spare surrounding healthy tissue as much as possible to ensure an acceptable risk of acute and late side effects and to maintain a good quality of life for patients.

Although there is a relatively robust literature base on the topic of advisory toxicity, there are relatively few data available mapping the effects of patient-side factors on the development of radiation treatment toxicity. Therefore, the primary focus of this paper is on interdisciplinary research on factors influencing the development of treatment toxicity.

A retrospective evaluation of the influence of comorbidities and some lifestyle factors on treatment outcomes in a cohort of patients irradiated for laryngeal cancer at the Institute of Radiation Oncology, 1st Faculty of Medicine, Charles University in Prague and Bulovka University Hospital between 2009 and 2018 was performed. In addition, the analysis of the radiation treatment plans was performed using statistical calculations and radiobiological modelling methods using artificial intelligence tools to investigate the influence of patient-side characteristics, tumour-side factors and radiation plan parameters on the development of treatment toxicity.

In the described patient cohort, a good treatment effect was achieved with an acceptable treatment side effect profile. Our results confirmed a statistically significant effect of comorbidities, history of alcohol abuse and marital status on overall survival, and the prognostic potential of baseline general status, hemoglobin level and weight loss was further confirmed.

The main part of the research was focused on identifying predictive factors of treatment toxicity. A significant influence of patient-side characteristics, tumour disease and radiation plan parameters on the development of different types of acute and late toxicity of (chemo)radiotherapy was proved. Specifically, the influence of TNM status, clinical stage, comorbidities, clinical parameters and lifestyle factors on the grade of acute and late toxicity was confirmed. Furthermore, a significant association of dose burden of organs at risk expressed as generalized equivalent uniform dose (gEUD) on the development of overall toxicity and some specific manifestations of adverse effects was observed.

This analysis provides a unique insight into the factors influencing the development of radiation treatment toxicity despite the limitations due to the small sample size and retrospective data acquisition.