Terminology, Recording, and Reporting for Ultra-High Dose Rates: ESTRO physics of FLASH workshop update

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There is mounting preclinical evidence that irradiations at ultra-high dose rate (UHDR) have the potential to improve the therapeutic index of radiation therapy (RT) by sparing normal tissues compared to conventional dose rate irradiations while maintaining tumour toxicity, a phenomenon termed the FLASH effect [1]. Since interest in UHDR irradiation was reignited in 2014 [2], research into this topic has steadily risen over the past years, with more than 200 papers related to FLASH RT published in 2022 alone [1].

Past shortfalls and inconsistencies in physics and dosimetry reporting of preclinical and translational studies may have contributed to a reproducibility crisis of radiobiological data in the field of radiation oncology [3-5]. Consequently, the development of a common terminology, as well as common recording, reporting, dosimetry, and metrology standards [6,7] is required. In the context of UHDR irradiations, the temporal dose delivery parameters are of importance, and under-reporting of these parameters is also an issue for which more rigorous and comprehensive reporting has been solicited [8].

This working group has been established to propose a standardization of terminology, recording, and reporting to enhance comparability of both pre-clinical and clinical studies and thereby aid the understanding of the conditions which give rise to the FLASH effect and to allow retrospective analyses. A consensus paper has been drafted with the aim to (i) provide a comprehensive and consistent terminology and framework for the characterization of temporal aspects of UHDR beam and dose delivery and (ii) propose minimal and optimal levels for a standardized recording and reporting of preclinical and clinical UHDR irradiations.

The recording and reporting parameters are designed to cover all radiation qualities, particle types, irradiator or treatment machine designs, as well as both broad beam and sequential beam deliveries (including pencil beam scanning). The recommendations define a range of temporal beam structure parameters, field or beamlet parameters, and treatment fraction parameters to report. Requirements for recording data are also given to enable reconstruction of the dose deposition with respect to time on a per voxel basis. An update on the recommendations of this group will be presented.

References:

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