A matter of debate: FLASH and particle therapy go head-to-head at ESTRO 2022

FLASH, with its ultra-high dose rates (ultra-HDR, >30-40Gy/s), and promise of improved sparing of normal tissue, is taking the field by storm. Particle therapy is demonstrating an exquisite ability to deliver doses precisely and perhaps to offer greater therapeutic efficacy than photon-based treatment. The room was packed at the 2022 congress of the European SocieTy for Radiotherapy and Oncology (ESTRO 2022) to hear Professors Kristopher Petersson, Clare von Neubeck, Charles Fouillade and Marco Durante argue the future of these two modalities in radiation oncology. Prior to the debate, 55% of the audience agreed that FLASH radiotherapy was a more promising avenue for the future of radiation oncology than particle therapy.

In relation to FLASH, we heard that ultra-HDR delivery could be achieved through the use of either photon or proton irradiation, and that treatment times could be shortened to split seconds. Pre-clinical evidence pointed to a 1.1-1.5 dose-modifying factor for normal tissue toxicity in mice without compromise of tumour efficacy. [1, 2] Its use had been shown to reduce acute inflammation and increase immune-cell infiltration. [3] FLASH irradiation combined with immunotherapy did not increase toxicity and suggested an exploitable synergy. [4] However, it was stated that a lot more research was required to explain the underlying mechanisms of the FLASH effect, and to overcome the technical challenges of delivering either photons or protons at such ultra-HDRs. [5] It was also pointed out that, in the case of deep-seated tumours, presently, FLASH treatment could only be performed in particle therapy centres.

With regard to particle therapy, the dose-sparing dose distribution afforded by protons could not be denied. The Bragg peak enabled the delivery of higher doses to the tumour than to normal tissue even with single beams; thus proton therapy also reduced treatment time. Our ability to treat patients with proton therapy was said to be rapidly evolving, despite outstanding questions surrounding the true value of the relative biological effectiveness. [6]

The debate audience wondered how much data was needed to convince clinicians that FLASH was ready to enter the clinic, whether the transition would be technology-driven, and what the time frame for the start of the first clinical trials of FLASH radiotherapy was likely to be. To answer these questions, perhaps we need to decide which patients should be treated with FLASH.

After a tense minute of silent voting, it was reported that the audience (N=109) had shifted to 65% in disagreement with the statement that FLASH radiotherapy was a more promising avenue for the future of radiation oncology than particle therapy. Only time will tell whether FLASH or particle therapy will dominate radiation oncology in the future.

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