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FLASH radiotherapy: Path to increase the therapeutic ratio?

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Abstract:

Radiation therapy is a core treatment modality that benefits the majority of patients with cancer at some point in their course. Delivering curative doses of radiation to tumors is limited by collateral damage to surrounding normal organs – increasing the therapeutic index between tumor eradication and normal tissue injury is key to every cancer therapy including radiation. The Stanford Department of Radiation Oncology, SLAC National Accelerator Laboratory and the Department of Radiation Oncology at Indiana University are developing a next-generation clinical radiation therapy platform that can deliver ultra-rapid radiation (FLASH) and complete treatment in less than a second for extremely precise radiation therapy, addressing the challenge of hitting moving targets like lung tumors by effectively freezing physiologic motion. We have already developed a unique preclinical FLASH irradiator for mice to study the biological impact of FLASH beyond the advantage of precise physical delivery. Remarkably, in a syngeneic subcutaneous C57BL/6 LLC tumor model, our preliminary data show enhanced tumor control with FLASH vs. conventional irradiation (i.e., sub-second vs. 5-minute delivery of the same radiation doses). Increased infiltration of T- and NK cells into the tumor with FLASH suggests an immune-mediated mechanism. Prior work also demonstrated dramatically decreased normal lung injury (fibrosis) with FLASH, and work in our lab and others has demonstrated sparing of other normal organ systems by FLASH, including the brain and GI tract. Taken together, these suggest FLASH radiation therapy will have a superior biological therapeutic index for cancer.

Host: Keith Stantz