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The Future of Charged Particle Therapy after Solving the Uncertainty Problems

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Radiation therapy with charged particles (protons, heavier ions) is associated with considerable uncertainties in range and biological effectiveness that limit its compatibility with photon IMRT in randomized clinical trials. In combination, these uncertainties often prohibit preferred beam directions because the risk of aiming the beam at organs at risk is considered too high. In therapy with heavier ions (helium, carbon), differences in RBE models limit the comparability of planned doses between different centers. Therefore, all current clinical trials with protons and ions may not test the full clinical potential of charged particle therapy and may lead to inaccurate results and wrong conclusions. In this talk, I will present solutions for a complete solution of the uncertain problem in charged particles and discuss the future of clinical trials in particle therapy after such solutions have been implemented. We may be at the verge of a phase shift in radiation therapy.

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