Minibeam radiation therapy: from photons to charged particles

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Despite remarkable advancements, the dose tolerances of normal tissues continue to be the main limitation in radiation therapy (RT). One possible solution could be to employ distinct dose delivery methods, activating different biological processes from those ones in standard RT. Along this line, the spatial fractionation of the dose, used in techniques such as minibeam radiation therapy (MBRT), has already demonstrated a significant improvement of the therapeutic index for radio-resistant tumors. MBRT, originated at synchrotrons, can now be explored outside large facilities thanks to its successful transfer into cost-effective equipment [1]. This allows a widespread implementation, the realisation of comprehensive and systematic biological studies and an easy transfer to potential clinical trials. In the recent years, the exploration of the possible synergies between the advantages of MBRT and the benefits of charged particles for therapy has started [1-6]. Proton MBRT [1] has been implemented at a clinical centre (Orsay proton therapy centre) and it has already shown an effectiveness of tumour control equivalent or superior than that of standard PT without the important side effects observed in the latter [2-4]. Concerning heavy ions MBRT, the favourable dosimetric data obtained supports the exploration of this new radiotherapy approach [5,6]. The advantages of MBRT over some other spatially fractionated RT will be discussed. The biological mechanisms in MBRT, which are not completely known, seem to contradict the classic RT paradigms. Its exploration offers a whole new horizon of both scientific research and potential future clinical practice.

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