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Do we need hadron therapy: a medical doctors point of view

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The main goal of radiotherapy is to maximize the damage to the tumor while minimizing the damage to the surrounding healthy tissue in the attempt to reduce acute and late side effects. Ion beam therapy (i.e. proton and carbon ion radiotherapy) is regarded as a promising therapeutic option because of its physical Bragg-peak characteristics. The fundamental rationale for the use of ion beam therapy is the improved physical selectivity, i.e. better dose conformation properties which enable better sparing of organs at risk and hence the potential of reducing side effects. Protons are typically indicated in tumors which are located next to radiosensitive structures (i.e. central nervous system, skull base or head and neck region). Furthermore, pediatric malignancies are considered as important indication for proton therapy; by limiting the dose to healthy structures using by proton a reduction in severe long time side-effects can be expected.
In addition to the physical Bragg-peak characteristics carbon ions are characterised by an increase in biological effectiveness when compared to protons. Considering different clinical situations, the biological advantages of carbon ions in comparison to protons are expected to be most pronounced for tumors that show low radio sensitivity.
In the early years of ion beam therapy, patients were treated at physics research facilities when beam time was available, whereas during the last decade a clear trend towards hospital-based facilities has been observed with a distinct market for proton facilities developing in the United States. In contrast to that, an interest in both, proton and carbon ion treatments or combined treatments particularly as provided in dual particle beam facilities can be noticed in Asia and especially Europe. Up to now there are five operating facilities worldwide which offer both beam qualities in one center. They are located in Hyogo (Japan), Shanghai (China), Heidelberg (Germany) Marburg (Germany) and Pavia (Italy). The sixth dual beam facility, MedAustron in Austria, is currently treating proton patients and will start with carbon ion treatment in the near future.
With regard to proton therapy, clinical experiences were mainly gained in the United States. By contrast, Japan has the most experience in the clinical application of carbon ion treatment with currently five ongoing centers. By the end of 2016 more than 149000 patients underwent proton- and 21500 patients underwent carbon ion treatment in operating treatment facilities worldwide.
Ion beam therapy has been applied to a variety of tumours like eye melanoma, scull base tumours, paediatric malignancies, prostate carcinoma, etc. and available clinical data appear to be promising. During the presentation, the clinical data will be presented in detail.

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