

## Clinical use of Proton Beam Radiation Therapy in the Tumor's Treatment (Lecture)

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### Abstract

Despite the rapid technological development, standard photon radiotherapy still brings a number of issues. Main problems are: lack of effectiveness for a number of indications; partly due to the inability to safely deliver the effective dose to the tumors; late and very late side effects of treatment caused by the unwanted dose delivered to the surrounding healthy tissue. The aim of the new methods in radiotherapy is to maximally reduce the dose to healthy tissue and to deliver the dose to the tumors as accurately as possible. Proton therapy comes closest to this goal from the all available methods. The principle of proton radiotherapy is use of accelerated hydrogen particles – protons, which are directed to the tumors. Due to the interaction of protons with the tissue, majority of the energy is deposited at a certain depth in tissue, in the so-called Bragg peak of absorption. The dose of radiation is very precisely delineated and there is no extra dose behind the tumors it. High-precise proton therapy requires a high-end technology within the whole radiotherapy chain. Tumor has to be examined and defined using combination of CT, MRI and PET. Reproducibility of the patient position requires special fixation devices. Each individual fraction of radiation must be done with image – guidance (IGRT) technology. The benefit of protons is minimizing the dose delivery to the healthy tissue. This applies for organs near the tumors and also for integral dose of organism. Therefore; proton therapy is most appropriate in situations where we expect a significant chance of curability in patient with expected long- term survival and high risk of side effects. Typical cases for proton radiotherapy are children with a malignant disease or brain tumors (meningioma, low-grade glioma) in young cancer patients. The second group of indications is cancers that are not curable with photon radiotherapy due to their location or low sensitivity to radiation. This group includes for example cancer of the pancreas or retroperitoneal sarcoma. Treatment results for various diagnoses will be presented. Proton radiotherapy is a new option in treatment of malignant tumors that pushes the limits of radiation oncology forward, onto a higher level.

**Key words:** Proton Radiotherapy, Physical Principles, the Technology, Clinical Use of Proton Beam Therapy.

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