MONITORING AND MANAGEMENT OF ANATOMICAL VARIATIONS DURING PROTON THERAPY TREATMENTS IN PEDIATRIC PATIENTS

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Background and Purpose: The use of proton therapy (PT) for pediatric tumors treatments has been consolidated over the years. This is mainly due to the advantages demonstrated respect to conventional therapy in terms of organs at risks (OARs) sparing, being anyway able to keep the same target coverage. As known PT is more sensible to anatomical/density modifications than X-rays therapy. The aim of the current study is to present the approach we use at our institution to monitor and manage anatomical variations in pediatric patients affected by cranial and spinal lesions.

Materials and Methods: Five cases, with different histology and location, were studied: one Skull base chordoma, one supratentorial glial neoplasm with an hygroma close to the target, one craniopharyngioma with cystic component, one glial tumor of the posterior cranial fossa with vermian residue and one atypical meningioma with residual disease in close proximity with the cervical portion of the spinal cord. Each patient underwent several CT and MR scans over the treatment course. In particular the following MR sequences were acquired: T2 (study of the cystic and hygromatous component), 3D Flair (study of the edemigenous component), 3D T1 (OAR anatomical definition), DWI (study of cellularity). The MR imaging was used to outline target and OARs on the control CTs; then the nominal plan was re-calculated on the control CTs. In case of target under dosage or OARs constraints violation a re-planning occurred in order to catch-up the dose prescription/constraints respect to the new anatomy/densities.

Results and Discussion: During the study, a total of 9 CT and 15 MR scans were acquired for the monitoring of the potential anatomical variations. Only in one case (i.e.: craniopharyngioma) the variation determined the treatment re-planning. This occurred at the 21st treatment fraction and it was due to the increase of the cystic component which was the object of monitoring.

Conclusions: In our experience with pediatric patients, monitoring and management of anatomical/density variations via repeated imaging over the treatment course is feasible and very important for the safe delivery of a PT treatment. In some cases it is used to trigger re-planning.