The remaining dosimetric parameters were affected only up to 1% by other planning factors except for increasing the margin between PTV and multi leaf collimators (MLC) edge (range, 1-3 mm) (1-7% difference). The best CI was seen with 9 static fields compared with DCA regardless of number of arcs used (2% difference). CI improved with the following - decreasing PTV to MLC margin (up to 10% difference), increasing number of static fields (1-2% difference), using 10 MV FFF (2% difference) and with arc length & table spread for irregular shaped targets (1% difference). Patient study Similar results were obtained with all techniques. Total mean number of MUs were 3144, 3166, 3121 for 3DCA, 4DCA and 9 static fields plans respectively. The mean CI was 2.3, 2.1 and 2.2 using 3DCA, 4DCA and 9 static field plans respectively. The normal tissue mean doses were 1.3% for all three techniques.

Conclusion: All evaluated radiosurgical plans were acceptable for clinical use. The technique was chosen based on delivery efficiency and dose to normal brain. 10 MV FFF was more efficient and more conformal. 4DCA delivers lower dose to a larger volume of the brain compared to 9 static fields which delivers higher dose to a smaller volume. The MLC margin is a compromise between CI and doses to the PTV. To conclude 4DCA 10MV FFF was chosen for clinical use, the MLC margin depends on the target volume.

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Tomotherapy dose painting hypofractionated treatments on GBM based on DW-MRI: a feasibility study, M. Orlandi1, A. Botti1, E. Cagni1, L. Orsingher1, R. Sghedoni1, C. Patrizia1, C. Iotti1, M. Iori1
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Purpose or Objective: To investigate the feasibility in Tomotherapy (HT) of a hypofractionated DP (Dose Painting) treatment on GBM (Glioblastoma Multiforme) cancer patients using ADC maps derived from DW-MRI.

Material and Methods: Five patients, who underwent GBM radiotherapy, were retrospectively considered, prescribing a dose escalated from 25 to 50 Gy in 5 fractions. The objective was that at least the 95% of the CTV received at least 25 Gy. DPBN dose prescription maps were generated from ADC-MRI, registered with planning CT, for each patient. The ADC pixel values (mm²/2s) within the CTV were converted to dose values (Gy) using the equation Eq. 1 where Dmin and Dmax are the minimum and maximum total dose of prescription (25-50 Gy). Imax and Imin are the minimum and maximum significative values of ADC selected on the basis of the ADC differential histogram, inside the CTV region.

Then it was necessary to discretize each DPBN maps in 9 isodose levels (Deveau et al., Acta Oncol. 2010) in order to obtain a corresponding DPBC map. The final DPBC map was realized minimizing, with an iterative process, the difference between DPBN and DPBC, evaluated by means of Quality Factor (QF) (Vanderstraeten et al., Phys. Med. Biol. 2006). The QF is, defined as in Eq. 2 and Eq. 3 where i is the i-th voxel. Then plans were optimized on a standard HT TPS and a TPS Dose Distribution (TDD) was obtained. For each patient the TDD was compared with the prescribed DPBN using a Qi distribution, defined as the ratio of TDDi and DPBNi. The quality of the treatment plans was evaluated in term of Qi and Q0.9-1.1, that represents the volume of the CTV in which the Qi ranges from 0.9 to 1.1. Eventually the delivery of the DP plans was assessed with Octavius system (PTW).

Results: Fig. 1 reports the different distributions obtained for Patient 1. Tab. 1 shows quantitative DVH and quality analysis of the treatment doses for the CTVs, mean values OAR Dmax for all patients, and γ results for the DQA performed. The constraints for the OAR were respected in all the five plans as well as the coverage of the CTVs with the minimum prescribed dose of 25 Gy. The QF ranges from 0.126 to 0.176, while the mean value of Q0.9-1.1 was 68% ± 7%. The delivery time ranges from a minimum of 38.3 minutes to a maximum of 63.6 minutes. All DQA performed are within the acceptance criteria with a mean value of γ of 87.4%.

Conclusion: Our results provides the feasibility of a ADC-based dose painting treatment in GBM cancer patients, respecting dose constraints to OAR and minimum target coverage. The plans obtained are deliverable, even if there is some concern about the HT delivery time. Clinical studies should be conducted to evaluate toxicities and tumor response of such a strategy.