Perfoming Methodologies used for the optimisation of radiation doses applied in Stereotactic Radiosurgery of a brain tumor

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This abstract is of interest for researchers in the field of Radiation therapy and Medical Physics, in particular, investigation of optimized radiation dose level in Radiation Therapy.

Purpose

Stereotactic Radiosurgery is a treatment modality applied on patient with single or multiple metastases. Brain metastases were detected approximately in 20-40% of cancer patients and it becomes mainly the reason of high risk of mortality because of various reasons, including factors related to the damage over the risk organs, history of patients, etc. The aim of this study is to study various dosimetry plans and efficiency of Stereotactic Radiosurgery (SRS) for single tumor and multiple metastases in brain and develop novel methodology to optimize delivered radiation doses with the target interest given to the critical tissues and risk anatomies.

Materials and methods

Study was performed on the bases of (n=35) of oncological patients with single tumor (n=0) and multiple metastases (n=23) treated on multiple photon and electron energy TrueBeam and EDGE with the fusion of images of high resolution CT guided simulator and 3T MRI. Size of the target varies from (22mm) to (29mm). Age of patients: (42-70). Treatment was conducted with parameters: MV=6FFF, MU=2400, number of fractions =5, total dose=30, total treatment time is approximately (3min) and Isodose volume VpIDGy was (27) and comparable to international standards. QA/QC was performed with the LUCI phantom with set up parameters: (PDD,OAR,,Scatter factor). Statistical analysis were performed using Box and Whisker analysis and regression models.

Results and discussion

The results of this shows that the single isocenter VMAT radiosurgery technique for the treatment of 1 or more brain metastases produces plans of high clinical quality, including favorable values for both CI and dose GI. CI and HI are evaluated for each target of plan, while a per-plan GI is calculated for each patient. The mean ± standard deviation CI was 1.15 ± 0.12 for all lesions; the mean ± standard deviation per plan GI was 3.37 ± 0.4; the mean ± standard deviation HI for all lesions was 1.446± 0.12. For single target plans (n = 5), the mean CI was 1.06, the mean GI was 3.04, and the mean HI was 1.48. For multitarget plans (n = 9), the mean CI was 1.14, the mean HI was 1.4, and the mean GI was 3.54.

CONCLUSION

In the settings for the treatment of brain metastasis, local control using the dose levels and delivery inthis cohort may be inferior to radio-surgical series. Local control is independent of histology. Careful selection of patients and individual set up protocols remains critical.