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Abstract

A simple method to evaluate the conformity index of individual targets while multiple targets are treated with a single plan of stereotactic radiosurgery/body radiotherapy

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Abstract

Objective: When multiple targets (like brain or liver metastasis) are treated either with stereotactic radiosurgery (SRS) or body radiotherapy (SBRT) using Cyberknife, it is our institute's common practice to combine the targets, though the individual targets are drawn separately, under one target label (CT), for planning and treatment execution, when the total dose and fraction size remains the same for all the targets. This practice helps to control the dose to the surrounding normal tissues, especially when the targets are closer and in a single set-up all the targets could be treated. The drawback is that the conformity index (CI) and the new conformity index (nCI) values of the individual targets displayed in the dose-statistics table, are not the correct ones. A simple method to find the actual values of CI of individual targets in such a situation is described here. Method: In a treatment plan done for multiple targets which are combined, though the coverage of the individual targets by the prescription isodose (PI) is displayed appropriately in the dose statistics table of Multiplan v8.5 (Accuray Inc., U.S.A), the corresponding CI values displayed are not correct. The system takes into account the total volume of the prescription isodose (PItot) and evaluates CI pertaining to the combined target, CT. While evaluating the CI of an individual target also, the same PItot value is considered and hence the discrepancy. In other words, the volume of the prescription isodose, just in and around an individual target alone is not considered. To circumvent this issue, a simple technique is proposed. Around a target, for example, T1, draw another target namely CFT1, by copying T1 using 3D copy option in the drawing tools under the tab "contour" and dilate it with an isotropic margin of 2mm. In all probabilities the PI for this target would be within this CFT1. Now, from the dose volume histogram of CFT1, the PIT1 pertaining only to T1, can be obtained and hence the appropriate CIT1 could be calculated. Similarly the CIT2, CIT3..,of the other targets T2,T3.., can be calculated, by drawing CFT2, CFT3.., An additional advantage with this practice is that the planner can give dose constraints to these margin contours CFT1, CFT2, CFT3., etc. and restrict the dose spilling as is performed by drawing shells. A plan with 3 targets in a skull phantom is done by combining the 3 targets, using different collimators for each target. A dose of 25 Gy in 5 fractions is prescribed to the 93 percent isodose line, while normalisation is done on the global maximum point. Results: The CI values as displayed in the dose statistics of the plan for the 3 targets are 12.34, 7.77 and 1.94 and the nCI values are 13.66, 8.35 and 1.94 respectively. On using the method described above, the following values of CI, 1.29, 1.21, and 1.39 are obtained for the targets T1, T2 and T3 respectively. The corresponding nCI values of the 3 targets are 1.58, 1.4 and 1.39 Conclusion:

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This method is relatively simple to practice to evaluate the CI and nCI of each individual target and document. But, the physicist or the planner needs to spend an extra time to derive value of PIV around each target, from the DVH and calculate. Software developers of the planning system can also consider incorporating this method, for multiple targets plan.