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Abstract

Critical Organ Based Gradient Index: A New Index Study

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Objectives: A sharp dose fall-off is very important because of the high dose applied on fewer fractions in radiosurgery treatment planning. However, there is not any parameter expressing the dose fall-off on a certain direction(s). The aim of the present study is to define a numerical preservation index of the critical tissues. This would allow an objective comparison of the treatment plans. The Critical Organ Based Gradient Index (CGI) numerically defines the dose fall-off that is specific to the critical organs due to Conformity Index (CI).

Methods: CGI is an index which indicates the dose fall-off in the critical organ, the maximum point dose and volume dose received by the critical organ: CGI=CI x Di/Dp ? _(cmax=1)^n¦Dcvol/Dcmax where; CI=The conformity index Dp=The dose value prescribed Di=The point dose received by the critical organ Dcmax= The maximum dose constraint for critical organ volume Dcvol= The dose received by the critical organ volume The Di states the maximum point dose obtained for a certain critical organ on the plan. Dcvol states the volume dose received by a certain critical organ. (NOTE: the formula does not display correctly in the system. Click on the MANAGE DOCUMENTS tab next to grading and then click download ick on the documents tab to see the formula as it should be.) Dcmax is the maximum dose constraint for a certain critical organ. Since the quality of the plan is related to CI, it is used in the formula as a parameter. We evaluate this new index in 30 vestibular schwannoma patients. We make a second plan with same coverage for each patient to compare with the plan that is selected for the actual treatment. CGI is used for comparing the plans. Contribution of CGI on the plan quality is discussed. Dose fall-off rate for certain critical organ is determined and evaluated numerically through CGI parameter.

Results: After evaluations of two different plan sets of 30 vestibular scwannoma patients with CGI, we observe a difference in critical organ dose fall-off. The actual treatment plan is better for 15 patients through this parameter in 30 patients. We calculate better CGI values in the second plan for other 15 patients. The smallest difference is 0.002 whereas the highest difference is found 0.24. Furthermore, a capability of standard desired dose fall-off value is defined and better treatment plans that achieve predefined dose fall-off value could be done.

Conclusions: We define a Critical Organ Based Gradient Index (CGI) numerically that allows an objective comparison of the treatment plans. If standard index values are defined for certain critical structures, we can use this predefined values to achieve better plans.

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