AbstractID: 11192 Title: Parameter Invariant TCP Radiation Therapy Plan Ranking

Purpose: To demonstrate via numerical simulations that the following statement cannot be rejected:
If for a given value of the radiosensitivity α, the following inequality $TCP(SF_2,\{v_i,d_i\}_1) > TCP(SF_2,\{v_i,d_i\}_2)$ is valid, then it is valid for any other value of α, where $TCP=\exp(-\rho \Sigma v_i SF_2^{di/2})$. The parameterization in terms of $SF_2 = e^{-2\alpha}$ was chosen because SF_2 is defined in the closed interval [0,1]. The dose-volume histograms (DVH) - $\{v_i,d_i\}_1$ and $\{v_i,d_i\}_2$ - correspond to two rival radiation treatment (RT) plans, for a given tumor site.
Method and Materials: It has been indicated in previous works that even though the exact parameter values of TCP and NTCP models might not be known with an apodictive certainty, the TCP/NTCP values may be used as a measure for RT plan ranking (1,2). We investigate only TCP based plan ranking here. It has been shown that gross tumor differential DVHs could be well represented by the Normal distribution with a certain mean and standard deviation (3,4). We generated 10^5 pairs of pseudo GTV DVHs, with a mean in the dose interval [40,70] Gy and a standard deviation - [1,4] Gy. For each pair of DVHs representing a pair of rival RT plans the corresponding TCP values as a function of SF_2 were calculated and compared.
Results: No cases contradicting the above statement were observed.
Conclusion: The knowledge of the exact values of the Poisson TCP model parameters is irrelevant for the purpose of RT plan ranking on the basis of comparing the outcome produced by the plans in terms of TCP.
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Conflict of Interest (only if applicable):