AbstractID: 7551 Title: Universal survival curve and SBRT hypofractionation

Purpose. Available clinical outcomes show that stereotactic body radiation therapy (SBRT) is very efficacious and well tolerated. At the same time, these outcomes show that standard linear quadratic (LQ) models do not provide adequate rationalization for the SBRT hypofractionation. The aim of this analysis is to show that multitarget model can be adapted to provide the proper framework for explaining the radiobiological rationale of the hypofractionated SBRT.
Method. Multitarget model leads to a formula defining a curve on the plane characterized by three free parameters with the following geometric interpretation: the initial slope ($1/D_1$), the final slope ($1/D_0$), and quasi-threshold dose (D_q), which is the D-intercept of the line defined by the terminal portion of the curve (D denotes the dose). In the range of ablative dose values characteristic for SBRT (8 – 30 Gy) only the final slope ($1/D_0$), and quasi-threshold dose (D_q) are of clinical relevance. Assuming that the LQ model gives a good description of the survival curve for conventionally fractionated radiation therapy (CFRT), and insisting on the linear, multitarget model type behavior of the survival curve for the high dose per fraction, we construct a universal, survival curve for the arbitrary range of dose per fraction. The additional constraints require the smooth, consistent transition for the universal curve in the dose range separating CFRT and SBRT and demand quantitative consistency with existing data.
Results. From universal surviving curve, we derive, for both CFRT and SBRT, two equivalence functions, biologically effective dose (BED) and single fraction equivalent dose (SFED). We find that SFED is the critical parameter for comparison of SBRT regimens as well as for comparison of CFRT and SBRT regimens.
Conclusion. The unifying survival curve provides empirically and clinically well justified rationale for the hypofractionation regime of the SBRT treatment modalities.