A novel 2D approach to survival analysis of SFRT in vitro irradiated A549 human lung carcinoma cells with established EBT3 dosimetry

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The linear-quadratic (LQ) model is a well-established tool that explain the dose-response of in vitro irradiated cells. However, the model fails to describe effects occurring when spatially modulating the field during spatially fractionated radiation therapy (SFRT/GRID), creating high and low dose regions. Cell flasks containing A549 human lung carcinoma cells were irradiated by Magnus Børsting, former M.Sc student, with and without a GRID block (striped or dotted). The flasks were then scanned and segmented by Delmon Arous, PhD student. A traditional LQ model was fitted for OPEN field irradiations, then used to predict SFRT survival. Resulting in and . Survival for high dose areas was overestimated by the LQ model with a percentage difference of . In low dose areas, the relative difference was about .  
A 2D approach was proposed, where the segmented cell flasks were divided into equally sized quadrats and the number of surviving colonies within each quadrat was found before feeding the data to a Poisson regression model. Cell dosimetry was established for the spatially modulated field, where GafchromicTM EBT3 films were calibrated and irradiated with 5 Gy nominally to obtain dose maps. The mean dose calculated for all OPEN field dose maps were .  
Dose and dose squared was used as explanatory variables in the Poisson regression, to obtain comparative results to the 1D LQ model. The 2D evaluated OPEN field regression with 0.5 mm2 quadrats, resulted in and **.** The model was subsequently extended to include survival data from all GRID irradiated cell flasks, and the ratio of high dose and low dose area along with distance from the quadrat centers to the nearest peak were added as regressors. The regressors were added to explain the effects occurring when spatially modulating the irradiation field. More analysis needs to be performed, but the preliminary result is all regressors having a sub 0.05 p-value for 0.5 mm2 quadrats.