AbstractID: 1263 Title: Extending the LQ Model for large fraction doses pertinent to radiosurgery

On going clinical trials designed to explore the use of extracranial stereotactic radiosurgery (ESR) for different tumor sites use large doses per fraction (15, 20, 30Gy or even larger). The question of whether the linear-quadratic (LQ) model is appropriate to describe radiation response for such large fraction doses has been raised and has not been answered definitively. It has been proposed that mechanism-based models, such as the lethal-potentially lethal model (LPL), could be more appropriate for such large fraction/acute doses. However, such models are not well characterized with clinical data and they are generally not easy to use. The purpose of this work is to modify the LQ model to more accurately describe radiation response for high fraction/acute doses. A new parameter is introduced in the modified LQ model (MLQ).The new parameter introduced is characterized based both on in vitro cell survival data of several human tumor cell lines and in-vivo animal iso-effect curves. The MLQ model produces a better fit to the iso-effect data than the LQ model. For a high single dose irradiation, the prediction of the MLQ is consistent with that from the LPL model. Unlike the LPL model, the MLQ model retains the simplicity of the LQ model and uses the well characterized α and β parameters. This work indicates that the standard LQ model can lead to erroneous results when used to calculate iso-effects with large fraction doses, such as those used for ESR. We present a solution to this problem.