AbstractID: 12934 Title: Comparison of four NTCP models to describe dose-response for radiation-induced optic neuropathy and retinopathy

Purpose: To compare four NTCP models to predict dose-response for the incidence of radiation-induced optic neuropathy (RION) and retinopathy (RIRP). **Method and Materials:** Logistic, log-logistic, Poisson-based and probit models were used to describe dose-response. Fits to four data sets were obtained: RION in 101 patients treated twice-daily (BID) and 172 patients treated once daily (QD), RIRP in 78 BID and 108 QD patients. Doses used in dose-response analysis were converted to isoeffective dose in 2-Gy fractions using α/β=1.76 Gy for RION and 2.65 Gy for RIRP. Maximum-likelihood profile method was used to obtain model parameter values, D_{50} and γ, and corresponding confidence intervals. **Results:** Within the dose range bounded by available clinical data, the model predictions were similar. For data sets spanning a broad range of incidence a reasonable consistency between model parameters was observed, however, the log-logistic model consistently showed larger D_{50} and shallower normalized slope γ. Specifically, for incidence of RION among patients treated QD, D_{50} ranged from 94.2 to 104.7 Gy and γ from 0.88 to 1.41. Model parameters for RIRP in the BID group were D_{50} from 72.2 to 75.0 Gy and γ from 1.51 to 2.16; in the QD group from 72.2 to 74.0 Gy and from 0.84 to 1.20, respectively. A large variation in model parameters was observed for RION in patients treated BID who showed incidence of complications spanning the range up to 20%. D_{50} ranged from 96.3 to 125.2 Gy and γ from 0.80 to 1.56. **Conclusion:** Log-logistic model tends to lead to larger D_{50} and lower γ compared to other models. Statements regarding normal tissue radiosensitivity and steepness of dose-response based on model parameters should be made carefully as the latter are not only model-dependent but also sensitive to the range of complication incidence exhibited by clinical data.