

AbstractID: 8703 Title: Dose response analysis of radiation-induced retinopathy (RIRP) single-institution data using the Lyman NTCP model

**Purpose:** To analyze the dose-response characteristics of radiation-induced retinopathy (RIRP) to high-dose radiation therapy using the Lyman NTCP model.

**Method and Materials:** A retrospective analysis of 108 patients treated QD (23 RIRPs observed) and 78 patients treated BID (7 RIRPs observed) in the head-and-neck sites were performed. Using the  $\alpha/\beta$  ratio determined with the QD group (2.65 Gy; [-1.06,∞] 95% CI), the total dose for each patient was converted to the normalized “2 Gy/fraction” total dose (NTD) before analysis. Subsequently, the Lyman NTCP parameters were estimated using the maximum-likelihood method with asymmetric confidence intervals determined using the profile-likelihood analysis (68% CI). The chi-square goodness-of-fit test was performed to evaluate the modeling.

**Results:** Due to the minute thickness and volume of the organ a DVH analysis was not performed. Instead, the dose to the retina was specified as the highest isodose covering at least 1/3 of the retinal surface that geometrically covered the observed retinal damage. Therefore, the volume effect parameter,  $n$ , was not investigated. The estimated values of  $NTD_{50}$  and  $m$  were 72.4 Gy [67.5,79.5] and 0.356 [0.29,0.44], respectively, for QD dataset and 73.0 Gy [67.0,85.5] and 0.209 [0.15,0.30], respectively, for BID dataset. While the  $NTD_{50}$  was generally in good agreement between the two groups, the BID group showed steeper slope resulting in lower incidence at clinical dose range (~ 30 to 60 Gy). The chi-square test showed that the model was adequate ( $p = 1.00$ ) for both the QD and BID groups.

**Conclusion:** The Lyman NTCP model was used to describe the RIRP data. Results show that QD and BID groups give comparable  $NTD_{50}$  values when NTD conversion is made. However, the BID group showed steeper slope. If the validity of the linear-quadratic formalism is assumed, then hyperfractionation may be beneficial for RIRP given the small  $\alpha/\beta$  ratio estimated.