AbstractID: 8697 Title: Dose response analysis of radiation-induced optic neuropathy (RION) single-institution data using the Lyman NTCP model

Purpose: To analyze the dose-response characteristics of radiation-induced optic neuropathy (RION) to high-dose radiation therapy using the Lyman NTCP model.

Method and Materials: A retrospective analysis of 172 patients treated QD (19 RIONs observed) and 101 patients treated BID (5 RIONs observed) in the head-and-neck sites, treated between 1964 and 2000, were performed. Using the α/β ratio determined with the QD group (1.76 Gy; [-1.41,∞] 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 functionally linear architecture and relatively small volume of the optic structure a DVH analysis was not performed. Instead, the dose to the optic nerves was specified as the minimum dose received by any segment of the organ to which the damage was diagnosed by ophthalmologic evaluation. Therefore, the volume effect parameter, n, was not investigated. For the QD group, the estimated values of NTD_{50} and m were 96.4 Gy [87,113] and 0.32 [0.26,0.40], respectively. For the BID group, the corresponding values were 104.6 Gy [81,233] and 0.31 [0.22,0.48], respectively. Both the NTD_{50} and m parameters were generally in agreement within the uncertainties estimated between the two fractionation groups. 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 RION data. Results show that QD and BID groups give comparable model parameters when NTD conversion is made. If the validity of the linear-quadratic formalism is assumed, then hyperfractionation may be beneficial for RION given the small α/β ratio estimated.