AbstractID: 10562 Title: Dose-response analysis of radiation-induced sensory neural hearing loss.

Purpose: To evaluate the the effect of total radiation dose received by cochlea on the risk of radiation induced sensory-neural hearing loss (RI-SNHL) using the Lyman NTCP model.

Methods and Materials: A retrospective analysis for RI-SNHL (audiology, otolaryngology, and radiation oncology records) of 410 patients (820 total ears) treated for selected treatment sites of head and neck cancers were performed. Due to the small volume of the organ, the dose volume analysis was not performed, instead the response was evaluated as a function of the average dose to cochlea. RI-SNHL was defined as 10 dB loss at high freq (4 kHz) or low freq (average of frequencies between 0.5-2.0 kHz). The Lyman NTCP model was used to describe the dose response. Parameters of clinical significance were estimated using the maximum-likelihood method with confidence intervals determined from the asymptotic covariance matrix (95% CI).

Results: The average doses to cochlea varied between 0.5 - 81 Gy. The estimated values of TD_{50}, m, and TD_5 (calculated) for high frequency hearing loss were 63.1±1.9 Gy, 0.263±0.043, and 36.0 Gy and those for low frequency loss were 81.3±5.5, 0.168±0.041, and 59.0 Gy, respectively. The calculated γ_{50} for high and low frequency SNHL were 1.52 and 2.38, respectively.

Conclusion: Lyman NTCP model fit to the RI-SNHL data for high and low frequency hearing loss showed significant variation in pattern of incidence of hearing loss with increase in the dose to cochlea**.** The probality of incidence of RI-SNHL at high frequency starts at lower dose (TD_5 = 36 Gy) and increases relatively slowly (γ_{50} = 1.52) compared with that for low frequency RI-SNHL (TD_5 = 59 Gy, γ_{50} = 2.38). The NTCP model fit to the clinical data suggets that the dose to cochlea be limited to 36 Gy to reduce the possibility of any RI-SNHL complications.