

Subjective Hearing Loss (SHL) after Chemoradiation for Nasopharyngeal and Oropharyngeal cancer Patients

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Purpose: SHL can be a significant complication after chemoradiation for head and neck cancer. Previous reports have noted a positive correlation between hearing loss and radiation dose delivered to the inner ear. We sought to analyze the effects of chemotherapy and radiotherapy on SHL in both nasopharyngeal (NPC) and oropharyngeal cancer (OPC) patients.

Methods: We identified 486 OPC and NPC patients treated with IMRT and chemotherapy at this institution between 1/04 and 4/09. After excluding patients with < 12 months follow-up, and those with unresectable treatment plans, 389 patients remained eligible for analysis. The median prescription dose was 70 Gy for definitive and 66 Gy for post-operative cases. Chemotherapy was given in 92%, the majority of which was cisplatin at 100mg/m² q3weekly. The inner ear was contoured on axial CT treatment planning images and the mean dose was recorded. Subjective measurements of clinical hearing loss events 1 year after the end of treatment were based on the CTCAE v4.0. Logistic regression was used to assess uni- and multi-variate correlation of $\geq$ grade 2 subjective hearing loss with: total cycles of cisplatin, left and right cochlea mean dose separately, their average, and their product; age and sex.

Results: Median follow-up was 34 months (range, 12-67). On univariate analysis, $\geq$ grade 2 SHL was significantly associated with left mean inner ear dose ($p=0.0009$), and right mean inner ear dose ($p=0.001$). Left inner ear dose was linearly correlated with right inner ear dose ($p=0.0007$). A univariate model based on the average of left and right mean inner ear doses (avdLR) predicted a 50% complication rate at 66.4 Gy. Above this dose the complication rate increased 2.7% for each 1 Gy increase in dose. Total cycles of cisplatin chemotherapy (TCC) was significantly predictive of SHL ($p=0.01$). Administration of neoadjuvant cisplatin chemotherapy also had significant correlation with SHL ($p=0.04$). Age and sex did not correlate with hearing loss. avdLR ($p=0.002$) and TCC ($p=0.04$) were significant in multivariate analysis. The avdLR that predicted a 10% rate of $\geq$ grade 2 SHL shifted from 55.5 Gy at TCC=0 to 44 Gy at TCC=3 to 37 Gy at TCC=5.

Conclusion: The results of our study have shown that $\geq$ grade 2 SHL is significantly related to the mean inner ear dose as well as the use of chemotherapy for a large group of oropharyngeal and nasopharyngeal cancer patients. Constraints to the average of the doses to the inner ears of 55.5, 44, and 37 Gy are recommended to ensure < 10% SHL in patient receiving 0, 3 and 5 cycles of cisplatin chemotherapy respectively.