Dosimetric Impact of Induction Chemotherapy in Nasopharyngeal Carcinoma

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Abstract

Objective: Concurrent radiation and chemotherapy serve as the standard treatment of locally advanced nasopharyngeal carcinoma (LANPC). The role of induction in chemotherapy followed by chemoradiation has yet to be revealed. We aim to report the dosimetric implications of neoadjuvant chemotherapy (NCT) in LANPC. Methods: Eight consecutive patients with stage III or IVa LANPC treated with induction chemotherapy followed by chemoradiation with tomotherapy were considered for our analysis. Neoadjuvant chemotherapy regimens consisted of docetaxel – cisplatin – 5-fluorouracil or cisplatin - 5-fluorouracil. Eight suppositional treatment plans were made based on computed tomography and magnetic resonance imaging taken before induction chemotherapy. The former plans were compared to eight treatment plans delivered to patients based on imaging taken after neoadjuvant chemotherapy. An experienced medical physicist optimized the plans as to respect the maximum tolerated dose to organs in the treatment field and deliver an appropriate dose to target volumes. Tomotherapy planning station version 4.04 algorithm was used to optimize plans. Results: Two patients presented with stage III, four with stage IVa and two with IVb LANPC. Pre-NCT gross tumor volume (GTV) and planning tumor volume (PTV) were 121.9 cc (SD: ±43.4) and 326.6 cc (SD: ±111) respectively. Post-NCT GTV and PTV were 90.6 cc (SD: ±47.9) and 193.0 cc (SD: ±114.6). Pre and post-NCT mean dose delivered to PTV were 70.3 grey (Gy) (SD: ±1.4) and 70.4 Gy (SD: ±0.5). The mean minimum and maximum doses to the PTV in pre-NCT plans were 45.0 Gy (SD: ±11.0) and 74.1 Gy (SD: ±1.8) respectively, whereas post-NCT mean minimum and maximum doses were 49.5 (SD: ±10.5) and 73.56 (SD: ±0.5). Univariate analysis demonstrated an association between induction chemotherapy and GTV volume (p= 0.01), PTV volume (p= 0.01). Upon evaluation of at risk
organs, a statistically significant association was seen between NCT and dose delivered to the brain (p= 0.02) and parotids (p=0.03). No such correlation was seen with dose delivered to the left (p= 0.75) and right (p= 0.35) eye, left (p= 0.58) and right (p= 0.40) optic nerve, spinal cord (p= 1.00), chiasma (p= 0.31) and brain stem (p= 0.24). When comparing pre- and post-NCT plans, the difference in mean doses delivered to the parotids was 2.4 Gy and to the brain was 8.6 Gy. Conclusion: Induction chemotherapy can help radiation oncologist prescribe a more homogenous plan and reduce the dose delivered to at risk organs such as the brain and the parotids. Neoadjuvant chemotherapy provides a benefit that can possibly reduce radiation therapy toxicities of LANPC.