

Carotid Dosimetry and The Risk of Carotid Blowout Syndrome following Re-irradiation with Head and Neck Stereotactic Body Radiation Therapy

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Abstract

Objectives: SBRT is an increasingly used technique for re-irradiation of recurrent head-and-neck cancers (rHNC). Rates of CBOS vary from 0-17% at a median of 4-5 months after SBRT, prompting some to aggressively spare the carotids or avoid SBRT in patients with arterial encasement. Our institutional practice has not excluded patients from SBRT based on carotid involvement or carotid dose. Thus, we aimed to correlate carotid dose and risk of CBOS; hypothesizing that carotid dose does not correlate with CBOS.

Methods: We retrospectively reviewed 186 patients with previously-irradiated rHNC treated from 2008-2013. Patients treated early in our experience with incomplete dosimetry were excluded. Patients were treated with linear accelerator-based SBRT to a median of 44Gy in 5 fractions delivered on a twice-weekly basis with concurrent Cetuximab. The bilateral common, internal, and external carotid arteries were delineated 2cm above and below the planning target volume. CBOS was defined as rupture and hemorrhage from the carotid or major branches following re-irradiation in absence of progressive disease. The maximum dose to 0.1cc (D0.1cc), 1cc (D1cc), 2cc (D2cc) and the mean carotid dose from SBRT were recorded and analyzed for association with carotid bleeding events using binary logistic regression.

Results: A total of 75 patients were identified providing 150 carotid arteries for analysis. Median follow-up was 8 months (range: 1-91) for all patients, and 37 months for surviving patients (range: 31-91). Median re-irradiation interval was 20 months (range: 3-423), and median prior radiation dose was 70Gy (range: 52.5-140). Sixteen patients (21.3%) received more than 1 course of SBRT, and the cumulative carotid doses from fused summary plans were recorded. The overall median D0.1cc, D1cc, D2cc, and mean carotid doses were 40.8Gy [interquartile range (IQR): 21.6-47.6], 26.8Gy [IQR: 14.1-42.1], 15.4Gy [IQR: 8.4-32.7], and 15.0Gy [IQR: 8.9-23.3], respectively. There were a total of 4 bleeding events (5.3%): 2 patients (2.7%) had mucosal bleeds that resolved following embolization of carotid artery branches, and 2 patients (2.7%) died from complications of CBOS. In the 2 patients suffering CBOS, the D0.1cc were 48.4Gy and 47.6Gy. There was no significant association between bleeding events and

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D0.1cc (p=0.117), D1cc (p=0.408), D2cc (p=0.981), or mean dose (p=0.990).

Conclusions: These results demonstrate a low risk of bleeding following re-irradiation with SBRT when 5 fractions are delivered on non-consecutive days even when tumor is completely encasing the carotid artery. While limited by the low number of events, no significant association was found between dose-volume parameters and the risk of carotid bleeding. No CBOS events were noted when D0.1cc was <47.6Gy.