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Abstract

Estimating Toxicities Following Stereotactic Ablative Radiotherapy Treatment of Locally-Recurrent and Previously-Irradiated Head and Neck Squamous Cell Carcinoma With A Normal Tissue Complication Probability Model

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Abstract

Objectives: Locoregional recurrence rate in squamous cell carcinoma of head and neck (SCCHN) following chemoradiation is high. The objective of this study is to determine dose-volume relationship to toxicities of normal tissues in previously-irradiated, locally-recurrent SCCHN (rSCCHN) treated with stereotactic ablative radiotherapy (SABR).

Methods: A retrospective review of 20 patients with previously-irradiated, locally rSCCHN from 2008-2011 was conducted. Tumors with a GTV less than 25 cm3 received 8.0 Gy per fraction for 5 fractions (total dose of 40 Gy); tumors with a GTV more than 25 cm3 received 8.8 Gy per fraction for 5 fractions (total dose of 44 Gy). Toxicity was graded based on Common Terminology Criteria for Adverse Events (CTCAE) v3.0. Physical dose was converted into 2Gy-per-fraction equivalent dose (EQD2) to correct for different fractionation schemes and allow for summation of SABR and previous IMRT plans. Logistic regression of composite dose volume histogram (DVH) data was performed in the DVH Evaluator software. Maximum likelihood parameter fitting was applied to solve TD50 (v) and normalized slope v50 of the exponential form of the logistic dose response model.

Results: Median age was 64 y/o (range: 45-87 y/o) with 14 (70%) males and 6 (30%) females. Thirteen (65%) patients received surgery and 12 (60%) patients received chemotherapy. The median previous radiation dose was 70 Gy (range: 63-118.2 Gy). The median time from prior radiation therapy to SABR was 12.5 months (range: 3-39 months). The median maximum SABR dose was 50 Gy (range: 47.3-55 Gy). The median prescribed SABR EQD2 was 88 Gy (range: 88-103.8 Gy) for a/b =3 Gy and was 60 Gy (range: 60-68.9 Gy) for a/b = 10 Gy, respectively. The median tumor volume was 27.3 cc (range: 4.4-75.7 cc). No Grade 4 or greater toxicity was observed. 1 (5%) patient had Grade 3 mucositis. 5 (25%) patients had Grade 2 mucositis and 6 (30%) patients had Grade 1 mucositis. Grade 2-3 mucositis correlated with median composite EQD2 to oral mucosa (TD50 (v) =190.8 Gy, v50 =0.3876). Outcomes were better correlated with

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median composite EQD2 to structures than to doses for small volumes, possibly due to tight small-volume dose constraints in SABR plans.

Conclusions: To keep the risk of Grade 2-3 mucositis below 25%, the median composite EQD2 to oral mucosa should be kept below 55.6 Gy. SABR has an acceptable toxicity profile in patients with previously-irradiated, locally rSCCHN. Our DVH model can estimate the risk of common toxicities such as mucositis based on median composite radiation dose to critical organs such as oral mucosa.