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Safety and Efficacy of HyperArc Stereotactic Radiotherapy (SRT) for Large Recurrent Head and Neck Cancers

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Abstract
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Abstract

Objectives:

Conventional radiotherapy treatment for recurrent large head and neck tumors poses significant technical and dosimetric challenges due to treatment-related toxicity. Recent studies have shown stereotactic radiotherapy (SRT) is a viable treatment option to manage these difficult patients. Here, we present a novel HyperArc volumetric modulated arc therapy (VMAT) SRT option for fast, safe, and effective treatment that allows for dose escalation to the tumor center while protecting adjacent organs at risk (OAR).

Methods:

Patients with large recurrent head and neck cancers underwent 30–40 Gy in 5 fractions HyperArc SRT to the planning target volume (PTV) with 2-3 mm margin around the standard gross tumor volume (GTV) derived from MRI or CT images with 15-20% hotspot into the GTV. Highly conformal SRT plans were generated using a fully automated HyperArc VMAT module on TrueBeam with 6MV-FFF beam (1400MU/min), Encompass support, Q-fix mask, and advanced Acuros-XB dose calculation algorithm for tissue heterogeneity corrections. Treatments were delivered every other day via pre-treatment conebeam CT-guided procedure and perfect pitch couch corrections. Patients underwent post-treatment computed tomography in 3-month intervals to evaluate for locally recurrent disease and distant metastases. Outcomes reported include tumor local control (LC), distant failure (DF), and treatment related head and neck toxicity following Common Terminology Criteria for Adverse Events (CTCAE, version 5.0) criteria.

Results:

Twenty-three head and neck cancers patients who either underwent retreatment (n = 17) or boost to primary tumor (n = 6) were evaluated. Median follow-up interval was 8 months (0 to 19 months). Mean GTV and PTV volume was 23.9 cc (range, 5.5–53.1 cc) and 50.3 cc (range, 16.9 ± 91.6 cc). HyperArc VMAT SRT plans provided highly conformal target coverage, steep dose gradient, and low doses to the immediately adjacent critical organs, including maximal spinal cord which was kept below 5 Gy. Average perfect pitch couch correction was < 1.7 mm and 2.2o in each direction. Average beam-on time was approximately 3.53 min. Overall mean treatment time including pre-treatment CBCT imaging, patient repositioning, and dry-run was within 15 min. All patients tolerated the HyperArc treatment. Tumor LC was observed in 17/20 (85%) evaluable patients with follow-up CT imaging and physical exam. Six (25%) patients died prior to three-month follow-up, and 2 (8.3%) patients died before post-treatment imaging could be obtained. Three (12.5%) patients experienced local tumor progression. No acute toxicities were reported in this cohort. Eight (33.3%) patients had distant progression, including metastases to the neck and hilar region (n = 1), occipital scalp (n = 1), carotid encasement (n = 1), pulmonary metastases to left upper lobe (n = 1), dermal metastasis (n = 1), and leptomeningeal spread (n = 1). No patients developed grade 2 or higher toxicity in the head and neck area.

Conclusion(s):

The novel HyperArc SRT treatment to large recurrent head and neck cancers provides fast, safe and effective therapy with promising LC rates and no adverse treatment-related toxicity, due to limitation of normal tissue exposure on account of HyperArc's steep dose gradient. Fast delivery of HyperArc SRT treatment could reduce intrafraction motion error, improving patient comfort, compliance, and clinic workflow. Use of HyperArc SRT for select cases is used in our institution, and our experience shows it to be safe. As this is a select cohort and very early clinical experience, we will report a longer clinical follow up as the data matures.