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High-Dose Hypofractionated Stereotactic Body Radiotherapy for Spinal and Sacral Chordoma

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Abstract
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Abstract

Objective: Chordoma is a rare, locally aggressive primary tumor of the spine, and has a high rate of recurrence even after en bloc resection with wide margins. Although radiotherapy is often utilized to decrease local recurrence, the optimal dose and fractionation scheme remain unknown. Stereotactic body radiotherapy (SBRT) may be a promising treatment option to overcome the radio-resistance of chordoma, but its safety and efficacy are not well defined. The purpose of this study is to review the outcome of patients treated with SBRT for spinal and sacral chordoma.

Methods: Patients with chordoma of the mobile spine (N=24) and sacrum/coccyx (N=6) were treated with image-guided SBRT at a single tertiary academic center between 2009 and 2019. Treatment toxicity was measured according to the Common Terminology Criteria for Adverse Events (CTCAE, version 5.0). Local recurrence (LR) after SBRT was defined as enlargement of the treated lesion and/or increased contrast enhancement on MRI.

Results: Twenty-eight patients (75% male) with 30 discrete lesions (23 newly diagnosed and 7 recurrent) were included. The median follow up duration was 18.8 months (range: 2.3-126.3). The median age at the time of SBRT was 56 years (range: 27-82), and the median Karnofsky Performance Score was 90 (range: 60-100). Of the 23 new lesions, the majority (N=17) were treated with neoadjuvant SBRT followed by surgery, with a median dose of 40Gy (range: 16-50) delivered in 5 fractions (range 1-5). Fifteen patients (88%) underwent planned en bloc resection, all with negative margins and two (13%) with close margins (<1mm). No patients in the neoadjuvant group experienced LR. SBRT treatments were well tolerated, and all acute toxicities were grade 1-2. After neoadjuvant SBRT and surgery, only 2 patients (12%) experienced wound complications that required surgical intervention. Five patients with newly diagnosed chordoma received adjuvant SBRT after surgery with a median dose of 40Gy (range: 30-50) in 5 fractions. Two patients (40%) experienced wound complications that required repeated surgery after surgery and adjuvant SBRT. One patient with newly diagnosed sacral chordoma received definitive SBRT 18Gy in 1 fraction without surgery due to advanced age and comorbidities, and remained alive with no evidence of disease 31.2 months after SBRT. The remaining seven patients received salvage SBRT without surgery to a median dose of 40Gy (range: 15-50) in 5 fractions (range: 1-5) for locally (N=2) or distantly (N=5) recurrent disease. Overall, two patients (1 in the adjuvant group and 1 in the salvage group) experienced LR, both of which occurred at BED2 <140Gy, while no LR was observed at BED2 >140Gy (p=0.06).

Conclusion: High-dose, hypofractionated SBRT for chordoma is safe and provides excellent local control. Preliminary data suggests that neoadjuvant SBRT followed by en bloc resection is associated with high local control and low toxicity, although longer term follow-up is needed.