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Abstract

MRI-Linac Guided Stereotactic Body Radiotherapy with Simultaneous Integrated Boost for Prostate Cancer: Initial Results of A Feasibility Study

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Objectives: Significant technologic advances allow prostate radiation to be delivered to high doses within 5 treatments, termed stereotactic body radiation therapy (SBRT). Recent innovations in MRI-based radiation therapy open new opportunities to further improve upon prostate SBRT outcomes by allowing precise, MRI-guided real-time delivery of treatment on an linear accelerator with live MRI guidance (MRI-LINAC) with focal boost to visible dominant intraprostatic nodules (DIN)s. We now report initial outcomes for a safety and feasibility study demonstrating use of MRI-guided Linac-based SBRT to treat the prostate with a simultaneous integrated boost (SIB) to DINs.

Methods: From 9/2018 to 10/2019, we enrolled a total of 30 patients with localized low (10%), intermediate (62%) and high risk (27%) prostate cancer who had evidence of dominant intraprostatic nodules. The DIN was defined as a biopsy proven lesion visible on MRI and/or PSMA PET. The prostate was treated to 36.25 Gy and the dominant nodule received a simultaneous integrated boost for a total dose of 37.5, 40, 42.5 or 45 Gy. The dose was determined by selecting the highest dose that met normal tissue constraints to the urethra and rectum. Feasibility was defined as a plan meeting treatment planning objectives and normal tissue constraints. Safety was defined as treatments delivered without grade 4 or 5 GI/GU toxicity within the first 30 days from start of treatment (CTCAE 4.0 criteria).

Results: The study met its accrual goal of 30 patients. Of evaluated patients, the mean pre-treatment PSA was 9.3 ng/mL (5.0-17.4). Mean pre-treatment AUA score was 8.8 (1-13). Mean gland size was 46.3 cc (30-75). The plan for all patients met feasibility criteria. All cases had greater than 98.5% of the PTV receiving at least 35 Gy. For all patients, dose to the DIN(s) was able to be boosted without exceeding normal tissue dose constraints. A total DIN dose of 37.5 Gy was achieved in 9 patient, 40 Gy in 14 patients, 42.5 Gy in 1 patient, and 45 Gy in 4 patients. No grade 3 or higher GI or GU toxicities have been reported.

Conclusions: SBRT planning and delivery on an MRI-LINAC allows delivery of a higher radiation dose to high-risk prostate nodules via simultaneous integrated boost without added acute toxicity. Local control, toxicity, and health-related quality of life data will require longer follow-up and be reported in the future. We are now planning to open a phase II study to assess

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the clinical efficacy of this approach.