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abstract

Plan-of-the-Day Adaptive Radiotherapy in Cervical Cancer: A Dosimetry and Clinical Feasibility Study

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Plan-of-the-Day Adaptive Radiotherapy in Cervical Cancer: A Dosimetry and Clinical Feasibility Study

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Introduction: Cervical cancer is prone to potentially large and frequent inter-fractional anatomical variations due to bladder and rectal filling that can compromise target coverage and increase organ at risk dose (OAR). While internal target volume (ITV) methods account for this, they often increase bowel exposure. We evaluated a Plan-of-the-Day (PoD) adaptive radiotherapy approach using a plan library to optimize coverage while reducing OAR dose.

Methodology: Eleven patients with stage IB–IVA cervical cancer received neoadjuvant chemotherapy followed by concurrent chemoradiation (45 Gy/25 fractions with 55 Gy SIB to pelvic nodes), weekly cisplatin, and image-guided brachytherapy. CT simulations with empty- and full-bladder protocols generated corresponding PTVs (EB-PTV and FB-PTV) for the plan library. Daily CBCT guided Plan-of-the-Day selection based on anatomical variations. Primary endpoint was OAR dose reduction; secondary endpoints were acute GI and GU toxicity.

Results: A total of 11 patients (median age 60, median stage III) contributed 275 fractions. Daily plan selection proved feasible, with 93% of fractions treated using the full bladder plan and only 7% requiring the empty-bladder plan. FB planning demonstrated superior dosimetry, achieving a median PTV V95 of 99% compared with 93% for EB ($p<0.05$). It also improved OAR sparing, reducing bladder V40 from 57.4% to 48.7% ($p<0.05$) and lowering irradiated small bowel volume by a median of 114 cm^3 (62% relative; $p < 0.05$). These findings affirm the dosimetric benefits of a full-bladder PoD adaptive approach. Acute grade >= 2 GU and GI toxicity reported in 18% and 20% respectively.

Conclusion: Daily CBCT–guided Plan-of-the-Day adaptive radiotherapy compensates for inter-fractional anatomical changes, has the potential to enable future reduced CTV-to-PTV margins. The PoD approach ensures target coverage while sparing bowel and bladder. Successful implementation depends on

patient compliance with bladder-filling instructions, emphasizing the need for consistent pre-treatment preparation to maximize adaptive radiotherapy benefits.

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