AbstractID: 9378 Title: Planning target volume adaptation using convex hull of CTVs for cervix cancer patients

Introduction

Adaptive IMRT planning studies have shown that intra- and inter- fractional organ motion can significantly decrease the coverage of the clinical target volume (CTV) for cervix cancer patients. Adaptive mid-treatment re-planning was effective in minimizing CTV underdosage, but this strategy only worked for patients with consistent bladder filling. This study investigated planning target volume (PTV) adaptation using a convex hull (CH) technique for patients whose bladder filling is variable over the course of radiation treatment.

Materials and methods

Nine cervix cancer patients with variable bladder filling during the treatment were selected from 35 patients enrolled in an adaptive IMRT planning study. All patients were MR-scanned once for planning and weekly during treatment. CTV and organs at risk (OAR) were contoured on each MR scan fused to planning CT with bony alignment. Contours were converted to 3D surface meshes for deformation analysis considering tissue biomechanics. Two MR scans with full/empty bladder were identified and an adaptive PTV was found using a convex hull algorithm in the research planning software. IMRT plans were generated on the CH PTV and accumulated dose on deformed organs were simulated.

Results

The average volume of CH PTV was 16% larger than that of small margin (3mm) PTV (477vs411cc). Most of the volume increase was found in the area of rectum where the concavity of the CTV was largest. The CH PTV had a non-uniform margin around CTV representing patient-specific CTV motion and deformation. The CH plan maintained target coverage but increased dose at OARs compared to adaptive mid-treatment re-planning.

Discussion

Adaptive planning strategy using convex hull of CTVs demonstrates good target coverage for cervix cancer patients with variable bladder filling. Refindment of the CH to spare OARs might allow a reduction in critical organ dose while still maintaining target coverage.