

AbstractID: 1796 Title: What margin should be used for prostate IMRT in absence of daily soft-tissue imaging guidance?

Although daily setup uncertainty (measured by radiographic bony landmarks) in prostate radiotherapy has reduced significantly over the years, the uncertainty associated with prostate-organ-motion caused primarily by daily variations in rectal and bladder filling status has remained large. Standard deviations (σ) greater than 8.0 mm in anterior-posterior direction have been reported. A recent study by Hua et al (IJROBP, 2003) using daily CT imaging showed that the posterior portion of prostate would be outside a 6 mm margin 35% of the time if only weekly portal imaging was used. While daily soft-tissue imaging improved the target coverage to 97% for the 6 mm margin, most clinics currently do not have access to this technology. In this work, we study the clinical implications of day-to-day prostate-organ-motion on two margin strategies used in prostate IMRT. Tumor control probability (TCP) calculated by an analytical approach and by full numerical simulation of the entire treatment was used as an evaluation index. It was shown that a traditional two-stage treatment, using 1.2 cm uniform margin for a primary course plus a non-uniform margin (1.0 cm all around except 0.6 cm posteriorly) for a cone down course, was more robust against prostate-organ-motion than using the non-uniform margin through the full course. The relative gain in TCP from using the two-stage margin strategy varied with the steepness of dose fall-off outside the margin: ranging from over 60% for sharp dose fall-off to over 10 and 5% for moderate and slow dose fall-off, respectively, at σ of 8 mm.