

The prostate is a mobile structure compared to the surrounding bony anatomy. Daily setup, immobilization and localization uncertainties can be addressed by increasing the PTV but may result in additional dose to surrounding normal structures. At FCCC we attempt to reduce the uncertainty by employing daily localization using ultrasound, implanted fiducials or through target tracking using implanted Calypso beacons. We currently use an 8mm growth in all directions except posteriorly where 5mm is typical. Patients with fiducials and those being irradiated in the post-prostatectomy setting undergo localization via an in-room CT scanner or CBCT. We have recently begun target tracking on post-prostatectomy patients as well. All patients are simulated and treated supine without a thermoplastic immobilizer to minimize respiratory related prostatic motion. Patients undergo MR and CT simulations with the rectum empty. These data are fused for target and normal structure delineation for use in treatment planning. Emphasis on soft tissue structures is important to avoid potential systematic localization errors due to the time difference between scans for patients with implanted fiducials or beacons. Dose limiting structures primarily include the rectum, bladder, and femoral heads, but may also include bowel and erectile tissues. We have developed "plan acceptance criteria" based on published data with respect to rectal complications. DVH analysis is used to ensure that the rectal volumes receiving 65Gy and 40Gy are less than 17% and 35%, respectively. Additionally, the bladder volumes receiving 65Gy and 40Gy are less than 25% and 50%, respectively. The volume of either femoral head receiving 50Gy should be less than 10%. PTV coverage should result in at least 95% of the volume receiving the prescription dose. It should be noted that the 3D dose distribution itself plays an important role in IMRT delivery and DVH analysis alone may not be sufficient. The isodose distribution should be such that the 90% and 50% lines do not traverse the half or full width of the rectum on any CT slice, respectively. Dose escalation and hypofractionation regimes continue to be of interest in the treatment of this disease site. However, most delivery techniques require PTV reductions to avoid increased normal tissue toxicity. A quantitative analysis of uncertainties contributing to PTV margins is addressed. Additionally, treatment methods that may not require margin consideration, are discussed. These include fiducial tracking using the Cyberknife and the use of high intensity focused ultrasound (HiFU) ablation.

Educational Objectives:

1. To understand the practical steps associated with IMRT of the prostate
2. To understand the numerical values presented for plan acceptance
3. To be aware of MR-CT fusion issues for patients with implanted fiducials or beacons
4. To be aware of issues related to PTV reduction