**Introduction**

Stereotactic body radiation therapy (SBRT) requires highly geometrical precision and accurate dose calculation. Pencil Beam (PB) dose algorithm is widely used because their short calculation time; however is well know that it reduce accuracy in presence of heterogeneities. It is well established by the literature, including AAPM recommendation, that lung SBRT requires more robust algorithm that takes into account loss of charged particle equilibrium (CPE) at the tumor/lung interface among the most accurate of which are Monte Carlo (MC). Recently SBRT had been implemented for prostate cancer, where rectum is the closest major heterogeneity and high precision dose prediction is needed especially in the urethral region where most of the complication had been reported.

The purpose of this work was to quantify the dosimetric impact of using Monte Carlo algorithm on pre calculated SBRT prostate treatment with PB dose calculation algorithm.

**Methods and Materials**

A 6MV photon beam produced by a Novalis TX (BrainLAB-Varian) linear accelerator equipped with HDMLC was used. Treatment plans were done using TPS IPlan v4.5 (BrainLAB) with PB and MC dose calculation algorithm, 9 beam incidences and sliding windows IMRT modality. Institutional SBRT protocol uses IGRT by ExacTrac (BrainLAB) with 4-5 radiopaque implanted fiducial markers, dose rate of 1000 MU/min and a total dose to the prostate of 40 Gy in 5 fractions, every other day (Figure 1). Each treatment fraction a rectal probe is used to reduce the gas into the rectum. Full bladder was used. The planning target volume (PTV) margin was 5 mm in all directions except for rectum where 3 mm was used. A central circular region of 10 mm radius was drawn along the PTV corresponding to the urethra (Figure 2).

Dose calculation is done by PB (2 mm dose resolution), heterogeneity correction and dose volume constraint (UCLA) for PTV D95%<40 Gy and D98%<39.2 Gy, Rectum V20 Gy<50%, V32 Gy<20%, V36 Gy<10% and V40 Gy<5%, Bladder V20 Gy<40% and V40 Gy<10%, femoral heads V16 Gy<5%, penile bulb V25 Gy<3 cc, urethra and overlap region between PTV and PRV Rectum (Rectum + 5 mm) Dmax<42 Gy.

10 SBRT treatments plans were selected and recalculated using Monte Carlo (dose to water) with 2 mm spatial resolution and mean variance of 2%. DVH comparisons between plans were done (Figure 3).

**Results**

Dose volume constraint differences for rectum, bladder, femoral heads and penile bulb were less than 2% and within tolerances, Table 1 and 2.

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**Conclusions**

Monte Carlo dose calculation on prostate SBRT using dynamic IMRT treatments could affect plan normalization. Dose increment in critical region of urethra and overlapping region between PTV and PRV rectum could have clinical consequences which need to be studied. The use of Monte Carlo dose calculation algorithm is limited because the TPS still use PB-based algorithms when performing beamlet calculation in IMRT optimization and MC is only use for the final dose calculation.