Purpose: To compare the bowel and rectal dose distribution in patients who have had a prior cystectomy receiving pelvic node irradiation using 3D conformal photon therapy (3DCT), intensity modulated radiotherapy (IMRT) or intensity modulated proton therapy (IMPT) planning technique.

Methods: We performed treatment planning for five patients generating plans with IMPT, IMRT, and 3DCT. The planning target volume (PTV) is nodal region including a 4 mm expansion for setup errors, and dosimetric uncertainty. The normal tissues of concern are rectum and combined small and large bowel. The dosimetric requirements for PTV includes a total prescription dose (PD) of 50.4 Gy for each plan with 95% of PD covers 98% of PTV volume (V95% = 98%) and the maximum dose not to exceed 107% of PD. Bowels and rectum dose constraints is D30% ≤ 40 Gy and the maximum dose not exceed 105% and 107% of PD for rectum and bladder respectively. For evaluation, each plan is normalized to PTV coverage criteria and V35% and V65%, V95% and mean dose are compared for bowels and rectum.

Results: The V95% for both IMPT and IMRT plans for rectum and bladder are much lower than 3D CT plans. The mean doses for bladder and rectum is 9.9 and 6.8 Gy for IMPT plans as compared to 23.7 Gy and 12.4 Gy for IMRT plans. These doses are higher for the 3DCT plan with the values of 32.3 and 28.2 Gy.

Conclusions: With equivalent target coverage, both IMPT and IMRT improve normal tissue sparing compared to 3DCT. The IMPT technique results in plans with better PTV coverage and lower dose to organ at risk as compared to plans with IMRT and 3DCT.