Purpose: To determine the impact of the deformation of rectum and bladder on the assessment of dose-volume constraints for these organs at risk (OARs) in adaptive prostate IMRT.

Methods: Five prostate cancer patients treated with both prostate and seminal vesicle as the initial PTV and with prostate only as the boost PTV were selected for this study. All patients received two CT simulations with the first CT scanned for the initial treatment volume followed by a second CT simulation after 45 Gy. All patients were treated to a total dose of 79.2 Gy in 1.8 Gy fractions delivered with seven-coplanner IMRT beams. MIM-Adaptive deformation workflow (MIMVista, Cleveland, OH) was used to perform deformation image registration of the two CT image sets. For evaluation of the accumulative dose delivered to the OARs in presence of organ deformation, MIM-Dose deformation tool was used to register the deformed dose matrices of two CT sets. The dose-volume constraints, D25% , calculated for rectum and bladder with and without consideration of organ deformation were compared.

Results: Differences in rectal D25% of up to 9.8% (from -9.8% to +2.8%) and in bladder D25% of up to 19.5% (from -19.5% to +9.0%) were observed. The deformation of OARs during IMRT caused the values of D25% for rectum to change from -646 cGy to +173 cGy and for bladder from -831 to +541 cGy from patient to patient.

Conclusions: Discrepancies in OAR dose-volume constraints can be calculated using modern deformable registration tools with and without consideration of organ volume change and deformation and should be carefully considered in the evaluation of OAR complication risks in adaptive prostate IMRT.