JULY 12–16 2020 VIRTUAL JOINT AAPM | COMP MEETING

Can Daily Online Adaptive Therapy Overcome Prostate Patients' Periodic Non-Adherence to Full Bladder/Empty-Rectum Protocols?

Mojtaba Moazzezi , Kevin Moore , Kelly Kisling , Casey Bojechko, and Xenia Ray
UC San Diego Health

UC San Diego Health
RETHINKING MEDICAL PHYSICS

INTRODUCTION

- Full-bladder/empty rectum protocol is used to minimize the positional uncertainties for radiation therapy of patients with prostate cancer.
- Patients sometimes have difficulty following it. Out of 43 prostate patients treated on our Halcyon in the past year, 29 were required to get off the table at least once to comply with the protocols.
- With online adaptation, the need for these protocols may decrease as the plan can be optimized for the patient's daily anatomical changes.

AIM

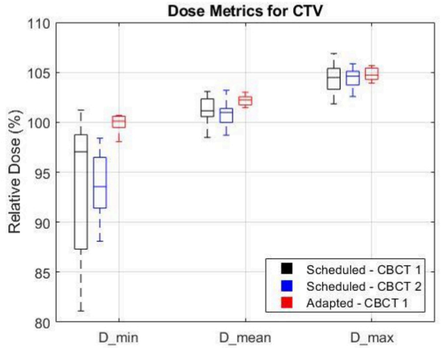
The purpose of this study was to determine whether prostate patients still benefit from the full-bladder/empty-rectum protocol when daily online adaptive therapy is performed on iterative CBCT images.

METHODS

- 10 retrospective prostate patients who had repeat CBCTs at one fraction to ensure proper bladder/rectal filling were identified.
  - First CBCT, inappropriate bladder/rectal filling
  - Second CBCT, acquired after the patient was given time to comply.
- The scheduled treatment plan was calculated on both CBCTs for each patient and was adapted and re-calculated on the first CBCT using the Varian Ethos™ adaptive platform.
- DVH metrics for the CTV (D_{min}, D_{max}, D_{mean}), Rectum (V90%, V75%, V50%), and Bladder (V90%, V75%, V50%) were extracted for each scenario, and compared using the average percent change (%Δ) in each and a Wilcoxon signed-rank test.

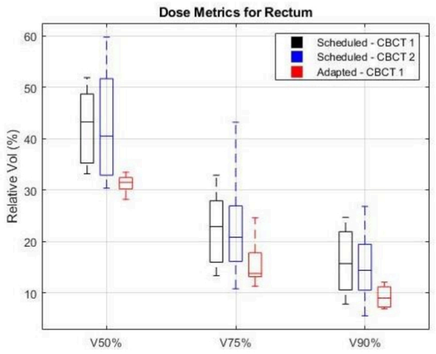
RESULTS

As expected, re-calculating the scheduled plan on the second CBCT (₿) maintained tumor coverage while decreasing rectum and bladder dose for all metrics when compared to the scheduled plan on the first CBCT (₿).



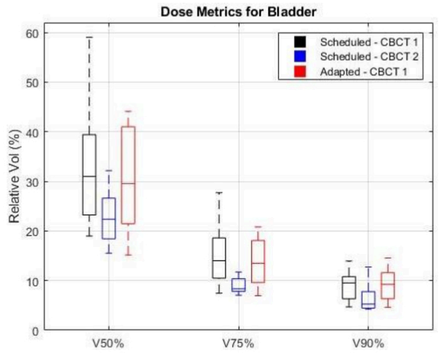
Adapting the plan on the first CBCT (₿) increased tumor coverage significantly compared to delivering the scheduled plan on the second CBCT (₿):

$\%\Delta D_{min}$= 6.9%±4.6% (p<0.01)
$\%\Delta D_{mean}$=1.4%±1.4% (p< 0.02)
$\%\Delta D_{max}$= 0.4%±0.8% (p<0.1)



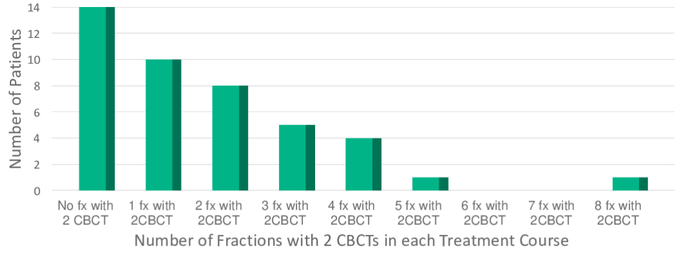
The adapted plan on the first CBCT (₿) had better rectal sparing and less variability than the scheduled plan on the second CBCT (₿),and it improved the 3 rectum metrics significantly:

%ΔV90%= - 6.3%±7.0% (p<0.01)
%ΔV75%= - 7.1%±8.1% (p<0.05)
%ΔV50%= - 10.2%±9.3% (p<0.02)

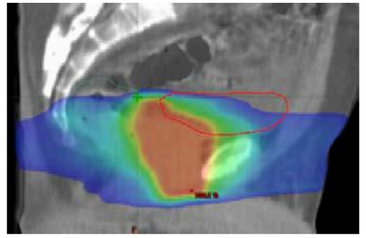


However the adapted plan on the first CBCT(₿) had worse bladder DVH metrics than the scheduled plan on the second CBCT (₿), and 2 of the 3 bladder metrics increased significantly:

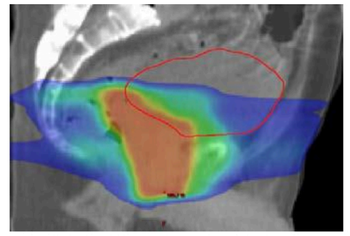
%ΔV90%= 3.0%±3.7% (p<0.05)
%ΔV75%= 4.2%±4.8% (p<0.05)
%ΔV50%= 7.3%±9.3% (p<0.1)



Protocol adherence varied by patient: 10 out of 43 patients only needed extra time to comply at 1 fraction while others didn't comply from 2 to 8 fx.



First CBCT with adaptation but poor bladder fill



Second CBCT without adaptation but good bladder fill

CONCLUSIONS

- **Daily adaptive therapy can improve tumor coverage and rectal sparing even when patients fail to adhere to empty-rectum protocols in any given fraction.**
- **However, a dosimetric benefit still remains for the full-bladder protocol in prostate, and thus patient compliance is still important for these cases.**
- **Using online adaptive therapy could improve clinical efficiency at these fractions and reduce patient stress.**

ACKNOWLEDGEMENTS

This work was supported by an internal grant from the Center for Precision Radiation Medicine. We acknowledge the technical support we received from Varian Medical Group.

CONTACT INFORMATION

Mojtaba Moazzezi,
mmoazzezi@health.ucsd.edu