2020 VIRTUAL JOINT AAPM | COMP MEETING
EASTERN TIME [GMT-4]

Adaptive planning, yes or no: On lung SBRT tumors with large shifts during daily image guidance

T. Ma, C. Liu, S. Ahmed, N. Yu, P. Qi, K.L. Stephans, G.M.M.Videtic, P. Xia
The Cleveland Clinic Foundation, Cleveland, Ohio

Cleveland Clinic

INTRODUCTION

Occasionally, large couch shifts can be observed due to these patient anatomic changes. In an FMEA analysis, they recommended that any overly large CBCT shifts > 1 cm should be alerted. However, with this abnormally large degree of couch shifts that is not due to human error, this study intends to identify whether to proceed with aligned setup is clinically acceptable or to stop the treatment immediately and continue with adaptive plans.

AIM

This study is to investigate whether adaptive re-planning is necessary for patients with identified large shifts.

METHOD

- Fifteen fractions from fifteen patients in whom recorded treatment couch shifts were > 1.5 cm in any directions based on daily kV-CBCT guidance.
- The treatment positions for these CBCTs were reinstituted through applying 6D couch shifts after rigid tumor-to-tumor registration with the corresponding planning CTs.
- The tumor volumes, including PTVs (5 mm expansion to the ITVs), ITVs, and GTVs, were subsequently transferred to the CBCTs from the planning CTs.
- The contours for lungs and patient bodies were automatically drawn on CBCTs through thresholding.
- The transferred tumor volumes and normal structures were further visually verified.
- The CBCTs aligned with treatment positions were then imported back into the treatment planning system for dose calculations with the treated beam configurations.
- To minimize uncertainties in the kV-CBCT Hounsfield Unit (HU), uniformed HU values were manually assigned to body contours (1.0 g/cm^3), ITVs (0.7 g/cm^3) and lungs (0.3 g/cm^3).
- The dose coverage to the tumor volumes was analyzed.

RESULTS

- With rigid tumor-to-tumor registration, D95% of PTVs in 7 of 15 fractions were 91.4%–94.6% of the prescription dose
- But 100% of GTVs and ITVs received 100% of the prescription dose for all 15 fractions.
- Assuming ITVs and PTVs were the targeted volumes in CBCTs during the treatment, it is appropriate to proceed with treating these fractions without re-planning.

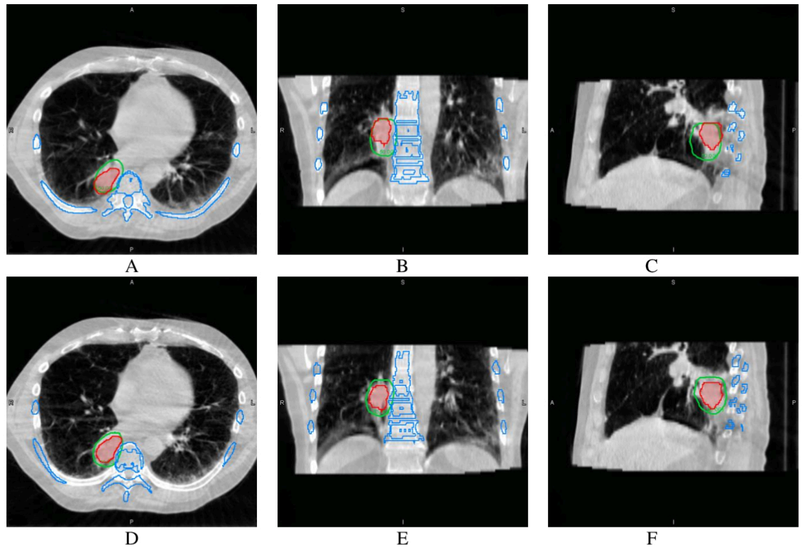

Figure 1. Case demonstration. ITV was indicated by the shaded red area, the bony structure contoured on the planning CT after the image registration was represented in blue, and the prescription isodose line was circled by the hollow green area. Bone-to-bone alignment was presented on the top row (figure A to C), in which the ITV was not completely covered by the prescription isodose line. In contract, tumor-to-tumor alignment presented on the bottom row (figure D to F) demonstrated that the prescription dose covered the ITV

CONCLUSIONS

Directly **aligning to tumor** enables us to achieve the treatment goal with adequate dose coverage to internal target volumes with a 5 mm planning margin, even for tumors with large positional changes. Re-planning is not necessary under these scenarios.

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CONTACT INFORMATION

Tianjun Ma

mat2@ccf.org