



# Evaluation of lung cancer SBRT plans with large daily tumor motion variations using daily 4D-CBCT

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## INTRODUCTION

- In general, 4DCT imaging is used to characterize organ/tumor motion during simulation by giving a snapshot of tumor motion. It is important that tumor motion is consistent during the treatment with the simulation to avoid over irradiation of healthy tissue or under coverage of the tumor.
- Motion encompassing SBRT plans use ITV based on tumor motion visualized on simulation 4DCT scans. This approach assumes consistent patient breathing during all fractions. Large tumor motion variations may not be easily detected using 3D-CBCT. **In this study, we evaluated tumor motion variations and dosimetric consequences using daily 4D-CBCT images.**
- This study aims to investigate variations in patient breathing and target motion throughout the treatment course and dosimetric consequences of large variations(>10mm).**

## METHOD

Simulation 4DCT and daily 4DCBCT images of twenty lung cancer patients treated with SBRT using varying fractionations (1, 3, 4 and 5) and with abdominal compression were analyzed (total 73). **Variation in tumor motion amplitude** (distance between centroids of end-of-inhale and exhale GTVs) and **ITV** (union of all phase GTVs) is defined as the difference between max and min values measured from all 4D images for each patient. Treatment plans (5mm PTV margin) of patients >10mm variations further analyzed dosimetrically using ITV/PTVs from daily 4D-CBCTs.

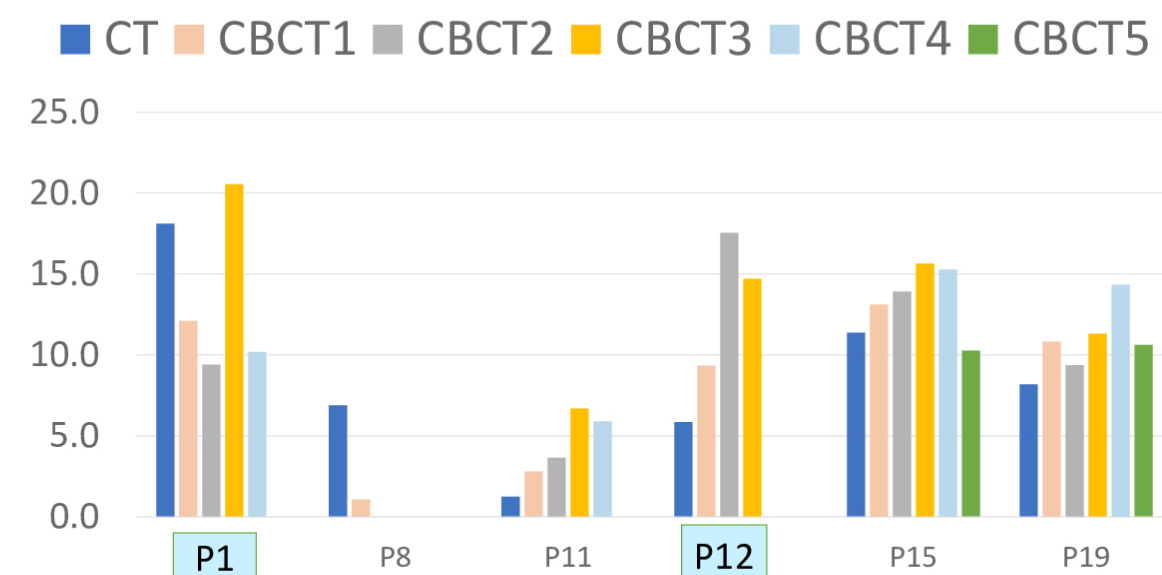
## CONCLUSIONS

4D-CBCT based daily IGRT detected large (>10mm) variations in lung cancer SBRT patient. Further studies are needed to develop adaptive treatment or gating options to mitigate the dosimetric effects caused by these large variations.

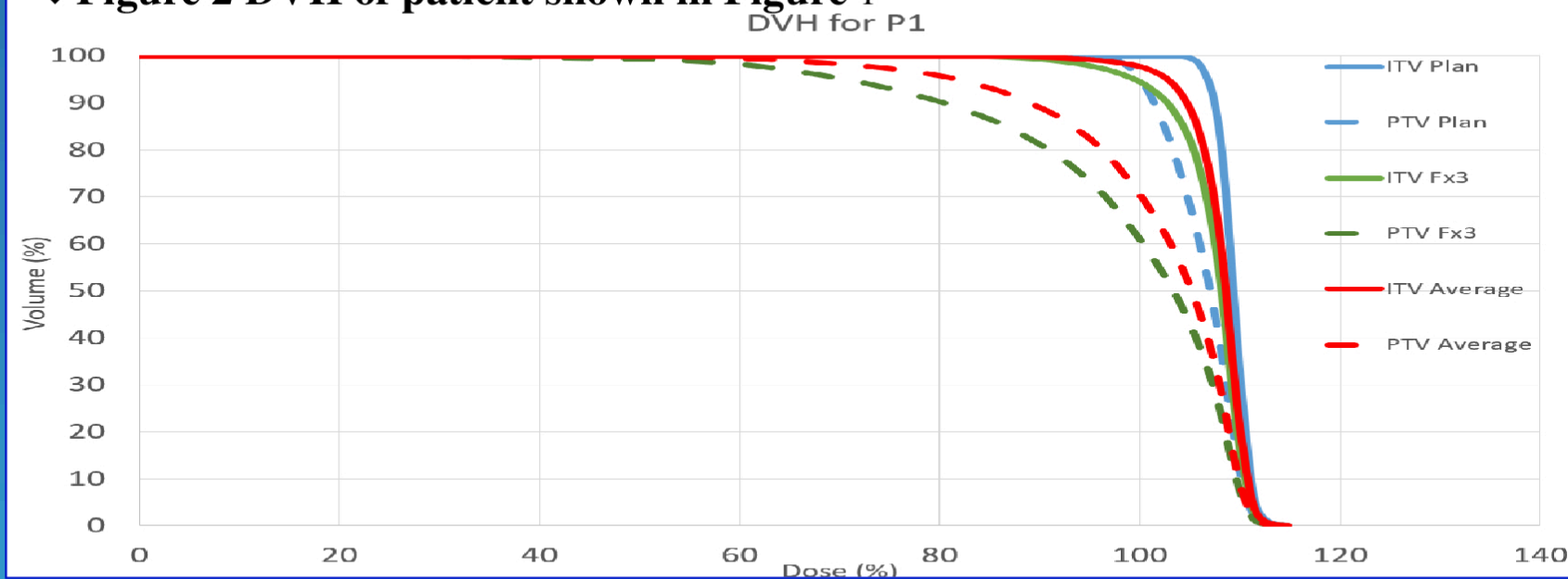
## RESULTS

- The mean tumor motion amplitude was  $9.0 \pm 4.1$  mm (1.1 to 23.0 mm) in all scans.

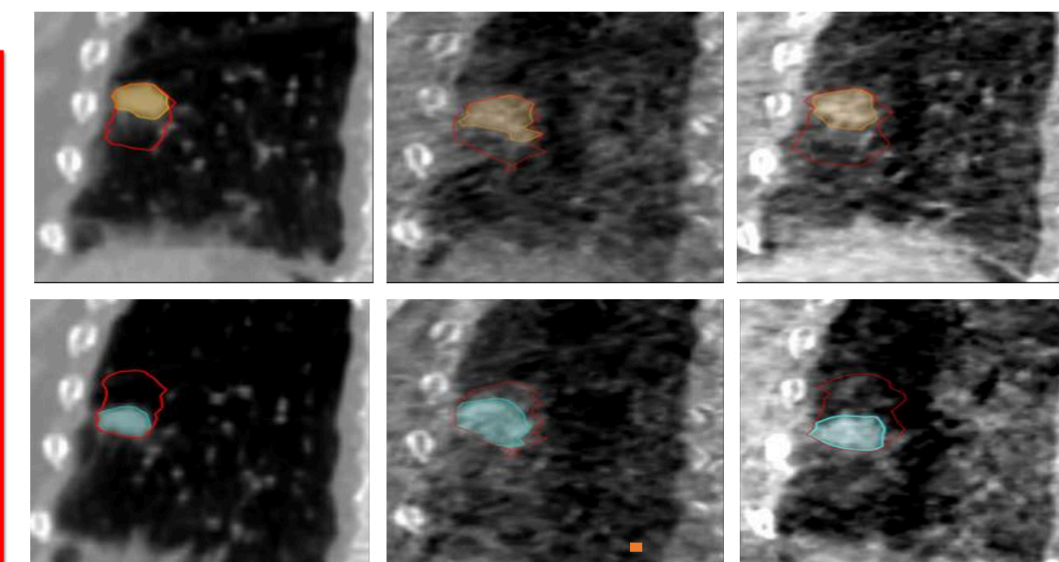
### ❖ Figure 1. Daily tumor motion for 6 patients > 5mm variation



### ❖ Figure 2 DVH of patient shown in Figure 1



### ❖ Figure 3. Variation in tumor motion observed for P1



Tumor motion difference between fraction 2 CBCT-9.4 mm (middle) and fraction 3 CBCT-20.5 mm (third column) was 11 mm.

DVH of patient shown in Figure 3. Largest variation was between fraction 2 and fraction 3. DVH is generated using the ITV/PTV contours from daily 4D-CBCT images and evaluating on the planning CT treatment plan. Average represents the mean delivered dose after 4 fractions.

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