

# IRRADIATED LUNG TISSUES IN ADAPTIVE RT APPROACH: SOME CRITICALITIES



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## INTRODUCTION

Stereotactic Body Radiation Therapy (**SBRT**) is a therapeutic option for limited stage non-small-cell lung cancer (NSCLC) and lung metastasis (LMET). In clinic the tumor motion is not ever taken into account and Gross Tumor Volume (GTV) is contoured on a free-breathing CT plan adding, sometimes, safety margins to avoid geometrical misses. Within Adaptive RT (**ART**) simulations it is possible to investigate the lung healthy tissues irradiated during entire cycle of treatment.

## MATERIAL and METHODS

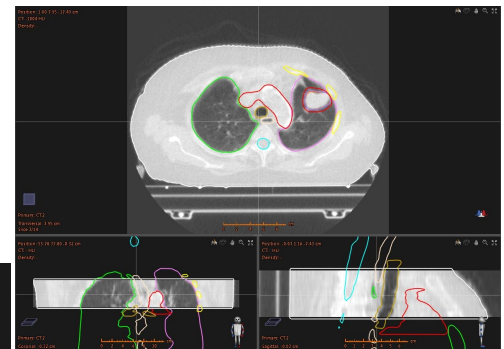
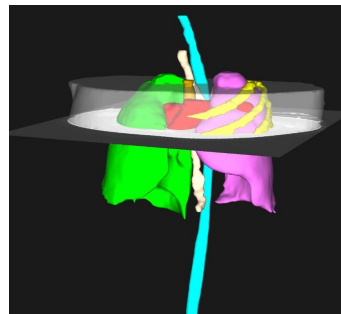
We have analyzed **8 patients (pts)** with mean age of 76 years (66-88) with NSCLC/LMET treated at our Institute with **Tomotherapy**. All pts were submitted to 4-6 fractions (fx) RT regimen: 3pts received 11Gy/fx, 1pts 12.5Gy/fx, 1pts 10Gy/fx, 1pts 7Gy/fx, 1pts 5Gy/fx. Using an experimental Treatment Planning System a pre-treatment hybrid deformable registration between kilovoltage (kVCT) and daily Megavoltage Computed Tomography (MVCT) images of each patient was carried out. **Hybrid deformable algorithms** (grid size 0.25 cm) were performed to obtain a voxel-to-voxel matrix for volume and doses. The Regions Of Interest considered in the ART simulation were: *lungs, heart, cord, ribs* and GTV. All pts analyzed were submitted to **follow-up** at 3, 6 and 12 months from the end of RT. Pts' characteristics have been evaluate in reference to acute and late toxicities.

## RESULTS

ART methods allow us to quantify divergences from "baseline" condition and to optimize the daily plan. However during post-processed analysis some **criticalities** have occurred. Due to small number of slices of MVCT compared to kVCT, morphing all large areas (such as lungs and cord) it is not allowed; warping methods should be done only for the GTV. Late toxicity was found in 7 pts: G1 in 5 cases, G2 in 2. Taking into account these preliminary results, a total lung acquisition should be acquired by MVCT, but unnecessary dose to Organs At Risk (OAR) could be delivered to apply **ART strategies**.

## GRAPHS AND TABLES

**Figure1** Axial, Sagittal and Coronal vision of a MVCT image with the contoured ROI of the initial kVCT



**Figure 2** 3D reconstruction of anatomical region for the SBRT patient

## CONCLUSIONS

This study is a first analysis to quantify criticalities that occur applying ART to standard SBRT cases. Acquiring entire anatomical region, using MVCT, to evaluate organ motion during RT does not seem the optimal strategy. To avoid recurrence possibilities, only a small fraction acquisition of entire lung remains preferable. Overall, to taking into account GTV shrinkage and to calculate the dose delivered at target and OAR, also **anatomical motion** must be accounted during each treatment session.

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