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4D Gated Stereotactic Body Radiation Therapy (SBRT) Experience in Primary and Metastatic Lung Tumor

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INTRODUCTION

Stereotactic body radiotherapy (SBRT) is the treatment of choice for patients with primary or metastatic lung tumor, who are medically inoperable or refuse surgical resection.

OBJECTIVE

To report technical features, early outcome and toxicity of lung stereotactic body radiation therapy (SBRT) treatments

METHOD

12 patients (9 newly diagnosed primary lung cancer; 3 secondary lung cancer), who were treated with SBRT between Oct 2016 and July 2018 were enrolled in this study. Detailed patient characteristics are shown in Table 1.

Table 1. Patient and tumor characteristics

Characteristics	Value
Age (y)	
Median	61.5
Range	36-87
Gender (n)	
Male	6
Female	6
Location (n)	
Upper lobe	10
Middle lobe	1
Lower lobe	1
PTV value (cm3)	
Median	3.56
Range	1.14- 53.62

All patients were simulated in the supine position and were allowed to breath freely using Siemens 4-dimensional PET-CT scanner to delineate the internal target volume (ITV). All patients had a 4DCT scan with 10 respiratory phase bins created. A 5mm margin was added to the ITV to generate the planning target volume (PTV).

45Gy in 5 fractions was used in the beginning of our SBRT programme. As the regime was well tolerated; the total dose was subsequently increased to 50-60 Gy in 3-5 fractions, with BED equal or more than 100. SBRT plans were generated using Varian's Eclipse treatment planning system. Treatment was planned such than 95% of the PTV is at or above prescribed dose. In addition to the target volume, the entire normal lung (whole lung-ITV), oesophagus, heart, ribs, and the spinal cord were outlined and considered during optimization. The following explicit planning objectives were defined: for the whole lung minus ITV: <1500 cc receives ≥12.5 Gy, oesophagus: <5 cc receives ≥27.5 Gy, heart: <15cc receives ≥32 Gy, spinal cord: <0.25 cc receives≥ 22.5 Gy , ribs: < 1cc receives ≥ 21Gy.

The patients were evaluated with thoracic computed tomography scans or PET/CT scans at 6 months after the initiation of SBRT.

RESULTS

Complete response was observed in 11/12 (92 %) patients and partial response in 1/12(8%). Toxicity was mild ribs pain and manageable radiation pneumonitis. D1500cc to both lungs resulted lower than 12.0 Gy; D5cc to oesophagus 4.5 ± 3.0Gy; D0.25cc to spinal cord was 10.2 ± 8.2Gy; D15cc to the heart was 10.2 ± 9.7Gy and D1cc to ribs was 15.2 ± 4.5Gy.

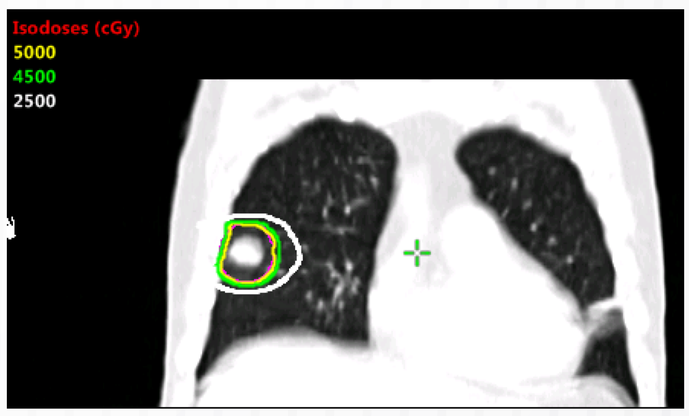

Figure 1: Isodose distributions for a newly diagnosed small cell lung cancer

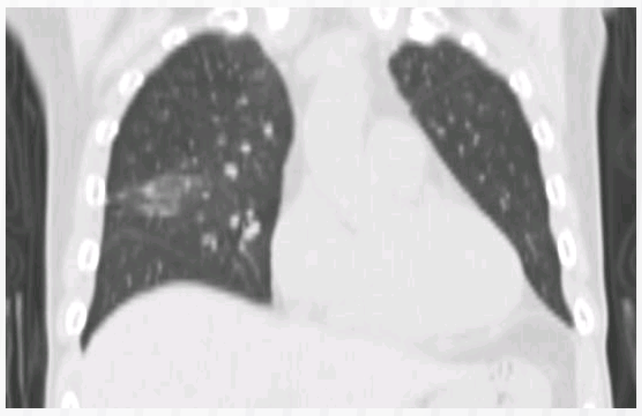

Figure 2: Radiological response 12 months after treatment

Table 2. Rate of radiation-associated toxicities

Adverse Events from Lung SBRT	Value
Radiation pneumonitis	3
Chest wall pain	1
Rib fracture	1
Esophagitis	0
Bronchitis	0
Spinal cord injury	0

CONCLUSION

Clinical results conclude that SBRT is a well-tolerated and effective alternative treatment option for selected patients with primary and metastatic lung tumors.