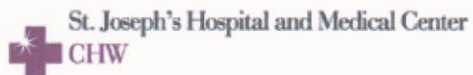


## NON-SMALL CELL LUNG CANCER LEFT UPPER LUNG

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St. Joseph's Hospital/Arizona Oncology Services

CyberKnife® Team:

Radiation Oncologist: John Kresl, M.D., Ph.D.

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Radiation Therapist: Nancy Bernstein, R.T.(T.)

CyberKnife Center: St. Joseph's Hospital/  
Arizona Oncology Services  
Phoenix, AZ

## NON-SMALL CELL LUNG CANCER LEFT UPPER LUNG

### DEMOGRAPHICS

**Sex:** F  
**Age:** 65  
**Histology:** Poorly differentiated non-small cell lung carcinoma with focal squamous features as T1 N0 M0 stage grouping I

### CLINICAL HISTORY

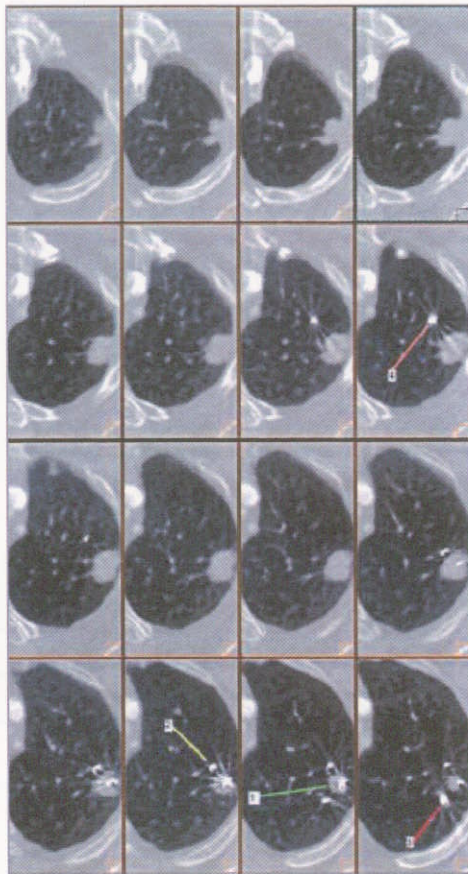
**Referred by:** Pulmonologist  
**Previous Treatment:** None

### Case History

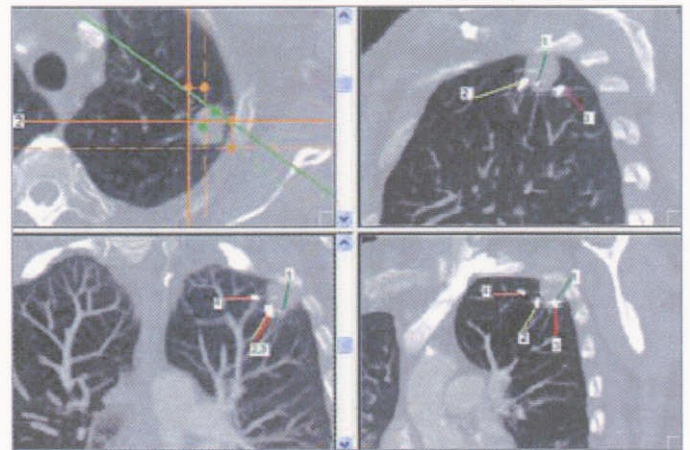
A screening chest X-ray demonstrated a 1.5 x 2.0 cm pulmonary nodule in the left upper lobe. Diagnostic images two years earlier demonstrated no evidence of a pulmonary nodule. A PET/CT scan identified a left upper pulmonary nodule with a maximum SUV of 22.7, suspicious for pulmonary lung malignancy. There was no evidence of distant disease. A CT-guided needle biopsy obtained a 0.1 x 1.2 cm sample of tissue; pathologic review of the biopsy specimen was consistent with poorly differentiated non-small cell lung cancer (NSCLC).

### CyberKnife Treatment Rationale

The patient refused surgery because she was concerned about a prolonged recovery. Her other treatment option in a non-surgical setting was radiation therapy. It was determined that the patient would be best treated with a stereotactic radiosurgery approach. Recent studies had shown that stereotactic body radiation therapy<sup>1</sup> had achieved therapeutic outcomes in the short run that approximated those achieved with surgical resection. Other studies revealed the feasibility of CyberKnife treatment of lung lesions.<sup>2,3</sup>



*Pretreatment CT: Sixteen consecutive 1.25 mm axial CT slices demonstrate an ovoid tumor dimension of 1.5 x 2.0 x 2.1 cm. Note the location of the four fiducials within the tumor (#1) and in close proximity to the tumor in the lung parenchyma (#2, 3 and 4).*



*Pretreatment CT: Multiplanar reformatted images show the lung tumor with four fiducials positioned in relationship to the ribs, bronchi and other anatomical landmarks. As in the previous figure, numbers indicate the 4 fiducial markers.*

**TREATMENT DETAILS**

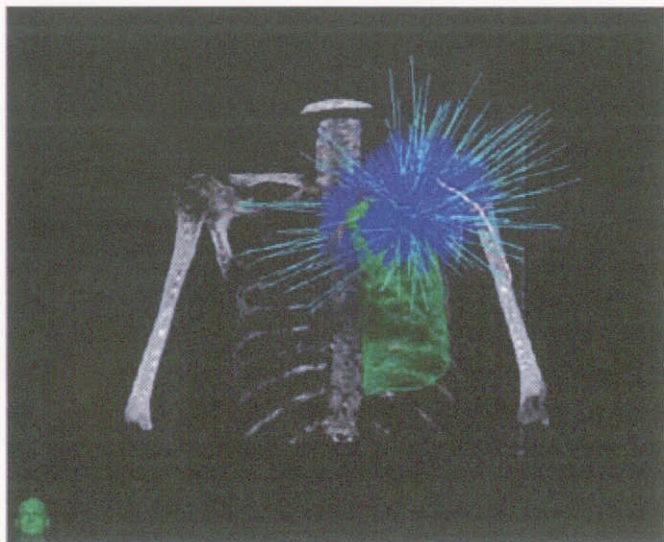
**Tumor Volume:** 13.85 cc  
**Imaging Technique(s):** CT, MRI  
**Rx Dose & Isodose:** 48 Gy to 71%  
**Conformality Index:** 1.37  
**Tumor Coverage:** 99.6%  
**Number of Beams:** 154

**Fractions / Treatment Time:** 3 / 78 minutes per fraction  
**Path Template:** 3 paths 900\_1000 mm  
**Tracking Method:** Synchrony™ Tracking System  
**Collimator(s):** 15 mm

**Treatment Planning Process**

The patient was treated with CyberKnife® robotic radiosurgery, which precisely targeted multiple non-isocentric, non-coplanar beams at the tumor. This delivered a large dose of radiation to a small field while sparing surrounding normal tissues and other critical structures. Prior to the procedure, the patient had permanent fiducial markers placed near the treatment site, then was immobilized in an Alpha cradle. MRI and CT were performed and data were transferred to the CyberKnife treatment planning computer where an optimal treatment plan was produced.

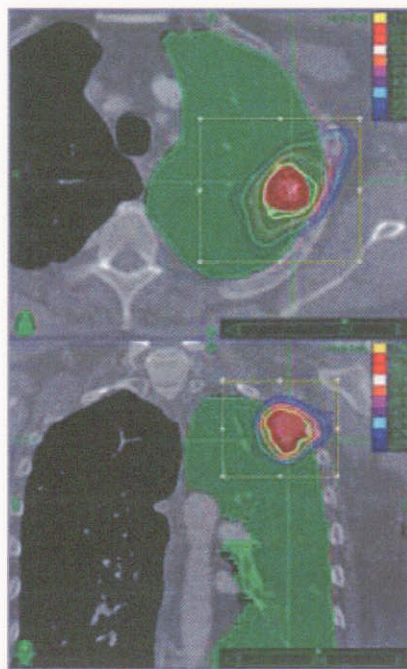
On each of the axial slices the gross tumor volume (GTV) was outlined to digitally reconstruct a 3-dimensional planning tumor volume (PTV) that measured 13.85 cc. The PTV had a 5-mm margin with respect to the GTV. A treatment plan was developed using 154 separately targeted beams from 72 unique robotic positions with the 15.0-mm collimator. The treatment plan was to deliver 48 Gy in 3 fractions of 16 Gy each. This dose was prescribed to the margin of the target volume at the 71% isodose line. This resulted in a homogeneity index of 1.41, a maximum tumor dose of 67.61 Gy, and a conformality score of 1.37, with 99.6% coverage of the target volume.



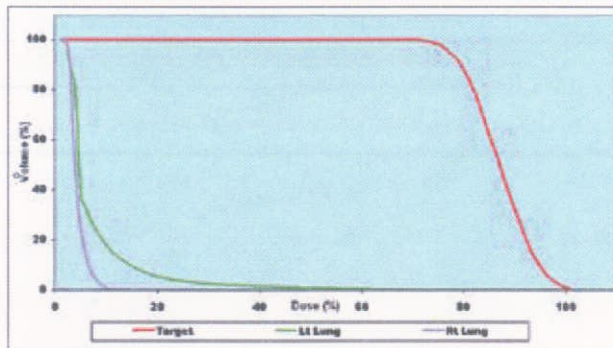
Anterior-posterior 3D rendering of bony anatomy, segmented lung, and beam orientations and intensities.

**Treatment Delivery**

The patient was immobilized in an alpha cradle. The treatments were delivered on 3 consecutive days using the Synchrony treatment module to compensate for patient movement and respiration during treatment. The patient tolerated the treatment well, experiencing no ill effects or changes in her pulmonary status during the therapy.



Axial and coronal planning images showing the tumor, lung parenchyma and isodose curves.



Dose-volume histogram (DVH) showing the dose delivered to the tumor and left and right lung.