

Treatment Team

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References

- ¹ Timmerman, Robert, Paulus, Rebecca, Galvin, James, et al. Stereotactic Body Radiation Therapy for Inoperable Early Stage Lung Cancer. JAMA. 303(11): 1070-1076, 2010.
- ² van der Voort van Zyp, Noelle, Prevost, Jean-Briac, van der Holt, Bronno, et al. Quality of Life after Stereotactic Radiotherapy for Stage I Non-Small Cell Lung Cancer. Int J Radiat Oncol Biol Phys 77:S31, 2010.



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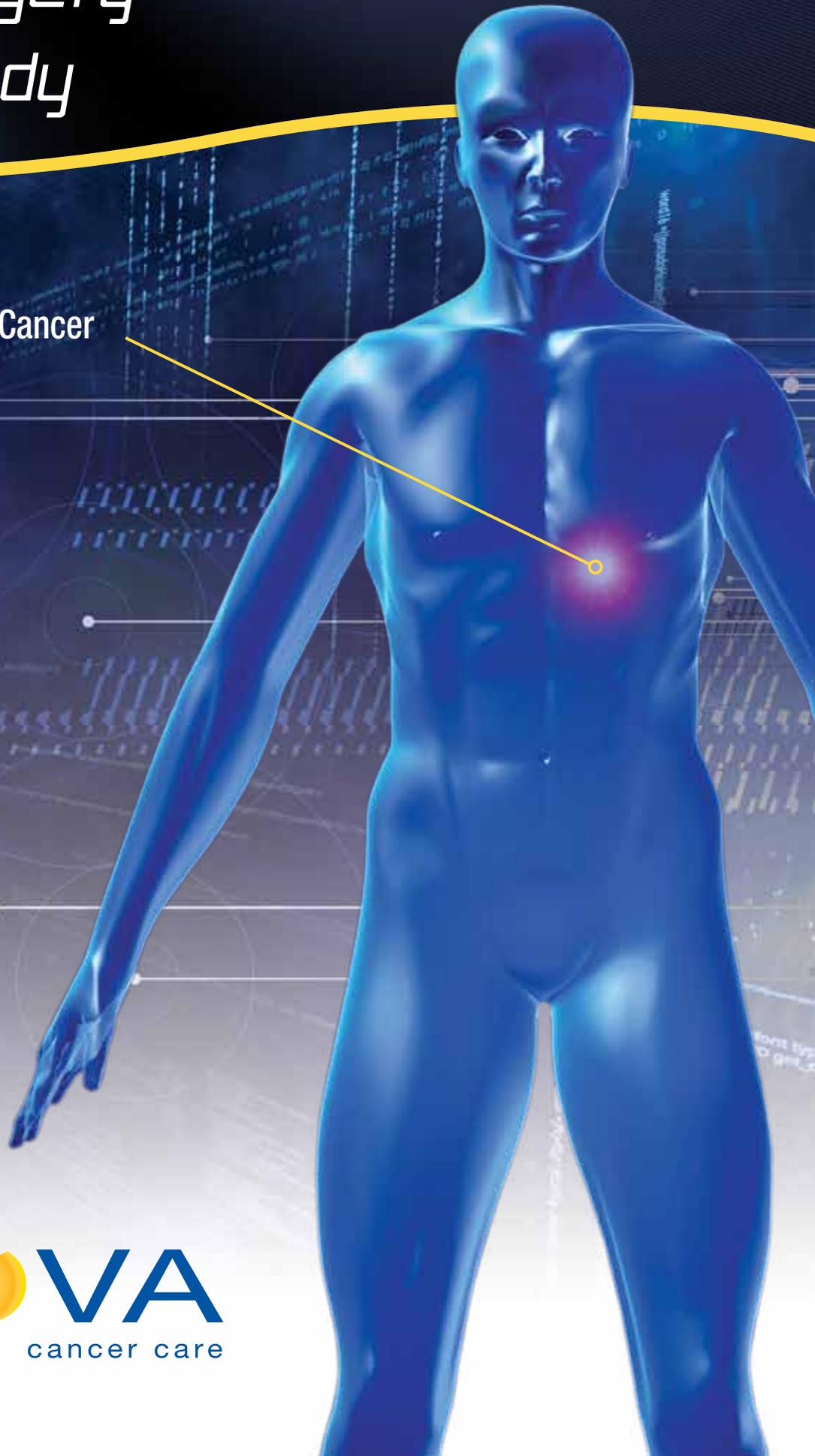
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Radiosurgery Case Study

Non-Small Cell Lung Cancer

March 2010



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cancer care

Radiosurgery Case Study

Case History

A 66 year old male (smoker x 40 years, quit in 2003) with a history of emphysema presented with an exacerbation of emphysema. A PET/CT was performed in June 2009 showing a 2.6 x 4.5 cm mass located medially in the left lower lobe (LLL) with a standardized uptake value (SUV) of 12.7, suspicious for malignancy. LLL biopsy confirmed non-small cell carcinoma with squamous differentiation. There was no PET evidence to suggest mediastinal involvement or metastatic disease. His FEV1 was 27% of predicted. He required 4L O2 with exertion, 3L at rest. With his severe emphysema, history of CVA, DM type 2 and anticoagulant therapy, this patient was not felt to be a good surgical candidate.

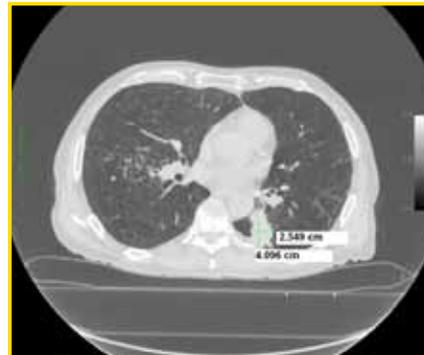
CyberKnife Treatment Rationale

When possible, Stage I NSCLC is treated by primary surgical resection. Conventional radiation therapy has been a treatment reserved for patients who refuse surgery or are deemed medically inoperable because of associated co-morbidities, with poor local control rates and significant toxicity. In recent years improved tumor control with relatively few complications has been achieved using high dose, hypofractionated stereotactic radiation delivery. Due to the patient's co-morbidities and his refusal of surgery, the patient chose CyberKnife treatment.

The CyberKnife System with the Synchrony Respiratory Tracking System delivers hypofractionated, high-dose radiation to lung tumors while minimizing deleterious effects to normal surrounding tissue by tracking and correcting for tumor movement throughout the respiratory cycle.

Planning Process and Goals

The patient was prepared for treatment planning by implanting three fiducials in close proximity to the LLL tumor transbronchially, using SuperDimension electromagnetic navigation along with CT guidance. A high-resolution planning CT scan was obtained seven days later. Fiducials were identified and the lesion was contoured and critical surrounding structures were identified. A multiple collimator treatment plan was created to deliver 50Gy in 4 fractions to the target.

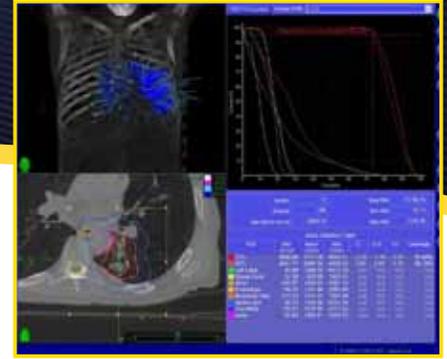
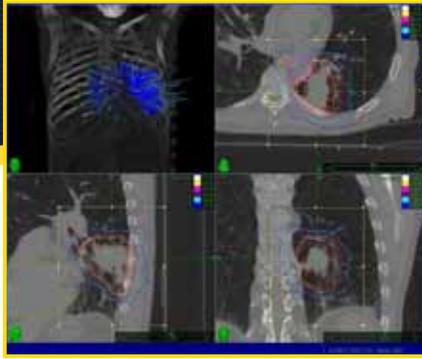


CT scan taken before treatment



PET/CT image two months prior to treatment

Results from a recent lung SBRT study using a gantry-based treatment system¹ showed a high rate of primary tumor control; however, approximately 15% of patients reported Grade 3 or 4 toxicity (pulmonary, musculoskeletal, hemorrhage). Comparatively, results from a CyberKnife-based lung SBRT study² demonstrated similarly high rate of tumor control with only 8% Grade 3 (musculoskeletal only) and 0% Grade 4 toxicity.



Treatment Delivery

The patient underwent CyberKnife treatment in an average of 90 mins/fraction using 196 beams/fraction. The prescribed dose covered 100% of the tumor target with homogeneity index of 1.37 and a conformity index of 1.13 for the PTV. The patient tolerated the treatment well.

Outcome and Follow-Up

In June 2009, the mass measured 2.6 x 4.1 cm with an SUV values of 12.7. Two months after CyberKnife treatment, CT imaging revealed an interval decrease in the size of the LLL lesion, which measured 2.0 x 3.2 cm. The patient did not feel that there had been any worsening of his dyspnea. Imaging revealed no infiltrates or findings consistent with radiation pneumonitis or pneumonia.

Seven months following treatment completion in March 2010, a PET/CT was obtained showing marked improvement in the left lower lobe lesion measuring 1.6 x 2.4 cm with SUV values of 2.9. There was no evidence of local, regional or distant metastatic disease.

The patient was seen for follow-up after the PET/CT. He stated that he was doing well with no side effects or changes in his quality of life. His oxygen needs have not increased since CyberKnife treatment and chest exam was stable.



CT image taken two months following treatment



PET/CT image taken seven months following treatment

Conclusions & Commentary

CyberKnife SBRT was an excellent option for this patient's early-stage, marginally operable/medically inoperable, lung carcinoma. He not only responded well to treatment, but there has been no adverse impact on his quality of life.

Stereotactic body radiation therapy is becoming the gold standard for thoracic surgeons and radiation oncologists for the management of this frail population of patients.

The results of RTOG 0236 reported three-year local control rates of 98% with moderate treatment-related morbidity.¹ It is worthwhile to note that treatment in this study was delivered on gantry-based linacs. In contrast, a recent CyberKnife treatment-based study reported two-year local control rates of 97%, with low toxicity rate and minimal severity.²