

Current Treatment of Early Stage Non-Small Cell Lung Cancer

Lung Cancer is the leading cause of cancer related mortality in the United States. In 2008, there will be 213,300 new cases of lung cancer and 160,390 deaths. About 85% of the new cases are non-small cell lung cancer (NSCLC). Only 25% of patients are operable at the time of diagnosis.¹ A quarter of the patients will have locally advanced disease² which poses considerable challenges and requires a multi-modality approach for management.

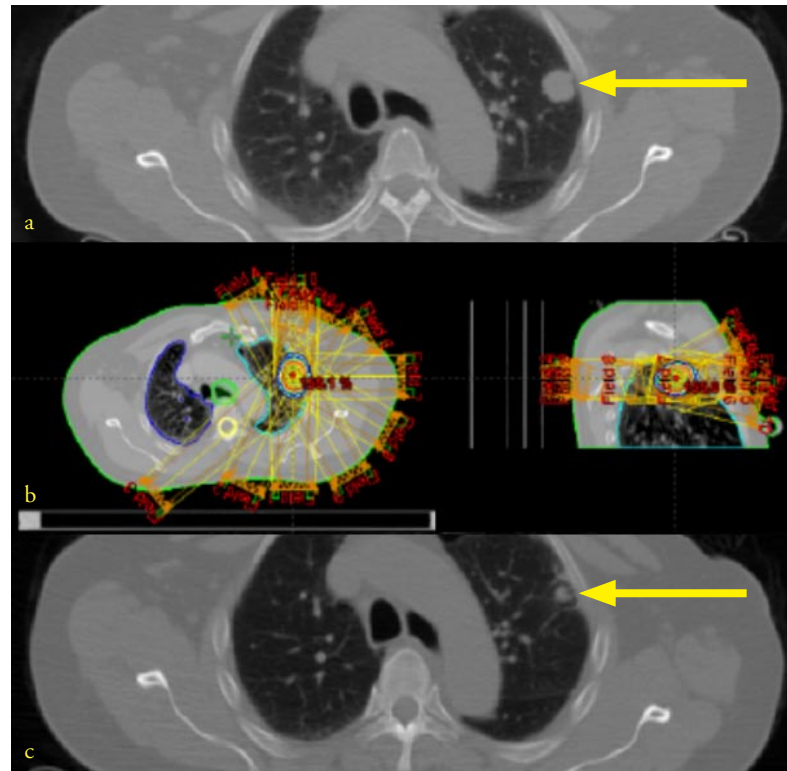
Traditionally Stage I or II lung cancers were treated with surgery with a 5-year survival of 63% for stage I³ and 26-33% for stage II⁴. Lobectomy had been the traditional surgery but now most patients receive video assisted thoracic surgery (VATS) which minimizes the surgical complications.⁵

For patients who were medically inoperable, fractionated external beam radiation therapy (EBRT) to 60 - 70 Gy was used with only modest results of 10 - 30% 5-year survival.^{6,7}

In the last 5 years the methodology of stereotactic body radiation therapy (SBRT) has been applied to patients who were mostly medically inoperable. The good results have led some institutions to treat patients who are medically operable.

The RTOG has established standards for SBRT⁸. A phase II protocol (RTOG 0236) from 5/04 to 10/06 entered 55 medically inoperable patients with 80% stage IA and 20% Stage IB. The treatment dose was 20 Gy per fraction for 3 fractions or 60 Gy over 1.5 - 2 weeks. The RTOG is now doing a phase II trial in medically operable patients (RTOG 0618).

Other groups or institutions have published their experiences with SBRT (see table on back). The studies included in the table represent a sample of the published data. In the first nine months



Top to Bottom: a) Pre-imaging (May 07): CT shows peripheral disease; PET (not shown) was positive for disease, b) SBRT treatment (May 07): 60 Gy in 5 fractions – 12 fields, c) Posttreatment images (Dec 07): CT shows minimal scar tissue, PET (not shown) demonstrated no pathological uptake; Posttreatment (Dec 08): Patient is alive with NED
 Images courtesy of Martin Fuss, MD, Oregon Health and Science University, Portland, OR

of 2008 there were 15 publications on SBRT for the treatment of early stage lung cancer, plus an additional 16 abstracts at ASTRO 2008. Outcomes of early clinical experience in medically inoperable patients are very encouraging and thus the use of SBRT is expanding.

Many treatment devices are able to deliver SBRT for lung carcinoma. Similar clinical outcomes have been reported using a variety of systems.⁹ Varian LINACs have been used in many studies including the largest study to date from Lagerwaard with cone-beam CT guidance.¹⁰

With an increase in diagnosis of Stage I lung cancer and improvements in the delivery of SBRT, it can be anticipated that more patients will receive SBRT with good outcomes.

Stereotactic Body Radiation Therapy for Lung – Selected References

Author	Institution	Year	# Pts	Dose (Gy)	# of Fractions	% Local Control	% Survival
Uematsu ¹¹ (Stage I)	Nat'l Defense Medical College, Japan	2008	131	50 – 60	5 – 10	96	54 at 5 years
Bradley ¹² (Stage I/II)	Washington University, St. Louis	2008	70	54	3	83	61 at 3 years
Kopek ¹³ (Stage I)	Aarhus University, Denmark	2008	89	45	3	89	72 at 2 years
Lagerwaard ¹⁰ (Stage I)	VU University Medical Center, Amsterdam	2008	206	60	3 – 8	98	81 at 1 year 64 at 2 years
Coon ¹⁴ (Stage I)	University of Pittsburgh Medical Center, Pittsburgh	2008	26	60	3	85	81 at 1 year
Timmerman ¹⁵	University of Texas Southwestern MC, Dallas	2006	70	60 – 66	3	95	55 at 2 years
Xia ¹⁶ (Stage I)	Air Force General, Beijing	2006	25	50	10	95	91 at 3 years
Nagata ¹⁷	Kyoto University, Japan	2005	45	48	4	98	88 at 3 years
Onishi ¹⁸ (Stage I)	University of Yamanashi, Japan	2004	245	18 – 75	1 – 22	85	88 at 3 years

Early Stage NSCLC: Survival After Treatment – SBRT vs EBRT vs Surgery

	Surgery	EBRT	SBRT
1 Year Survival	95% ³	80% ⁷	81% ¹⁰
2 Year Survival	84% ³	39% ⁷	64% ¹⁰
5 Year Survival	63% ³	13% ⁷	N/A
Local Failure	<20% ³	43% ⁷	3-5% ¹⁰

References

- American Cancer Society Facts and Figures 2008
- Gunderson & Tepper *Clinical Radiation Oncology*, 2nd Edition, 2007, p. 879
- Harpole DH et al. *Cancer* 1995; 76(5): 787-796
- Winivesky JP et al. *Lung Cancer* 2005; 49(2): 181-186
- Haasbeek CJ et al. *The Oncologist* 2008; 13: 309-319
- Cheung PC et al. *Int J Radiat Oncol Biol Phys* 2000; 48(3): 703-710
- Sibley GS et al. *Int J Radiat Oncol Biol Phys* 1998; 40: 149-154
- www.RTOG.org
- Nguyen NP et al. *Cancer Treat Rev* 2008 in press
- Lagerwaard FJ et al. *Int J Rad Onc Biol Phys* 2008; 70(3): 685-692
- Uematsu M et al. *Int J Rad Onc Biol Phys* 2008; 72(1): Supplement S37
- Bradley JD et al. *Int J Rad Onc Biol Phys* 2008; 72(1): Supplement S37-38
- Kopek N et al. *Int J Rad Onc Biol Phys* 2008; 72(1): Supplement S37
- Coon D et al. *Clinical Lung Cancer* 2008; 9(4): 217-221
- Timmerman R et al. *J. Clinical Oncology* 2006; 24(30): 4833-4839
- Xia T et al. *Int J Rad Onc Biol Phys* 2006; 66(1): 117-125
- Nagata Y et al. *Int J Rad Onc Biol Phys* 2005; 63(5): 1427-1431
- Onishi H et al. *Cancer* 2004; 101(7): 1623-1631



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