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**Self Assessment Module on Stereotactic Body Radiotherapy (SBRT)**

**Submitted by:**

Billy W. Loo, Jr., MD, PhD, DABR  
Assistant Professor and  
Thoracic Radiation Oncology Program Leader  
Stanford University and Cancer Center

**Question #1:** In patients with Stage I Non-Small Cell Lung Carcinoma (NSCLCa) stereotactic body radiation therapy (SBRT) results in local control of approximately:

- A 75-95%
- B 50-60%
- C 25-30%
- D 10-20%

**Correct answer:** A

**Rationale** Indiana University phase I/II trial local control 88%

**Reference:**

Fakiris AJ, McGarry RC, Yiannoutsos CT, Papiez L, Williams M, Henderson MA, and Timmerman R; Stereotactic Body Radiation Therapy for Early-Stage Non-Small-Cell Lung Carcinoma: Four-Year Results of a Prospective Phase II Study. *Int J Radiat Oncol Biol Phys.* 2009 Nov 1;75(3):677-82

**Question #2:** "Central" tumor location as defined in lung SBRT is:

- A tumors within 1 cm of trachea
- B tumor abutting the trachea
- C tumors within 2 cm from the proximal bronchial tree
- D tumors abutting aorta, heart, or pulmonary artery

**Correct answer:** C

**References:**

RTOG 0236 protocol ([www.rtog.org](http://www.rtog.org))

Timmerman, R, McGarry, R, Yiannoutsos, C, Papiez, L, Tudor, K, DeLuca, J, Ewing, M, Abdulrahman, R, DesRosiers, C, Williams, M, and Fletcher J; Excessive Toxicity When Treating Central Tumors in a Phase II Study of Stereotactic Body Radiation Therapy for Medically Inoperable Early-Stage Lung Cancer. *JCO* Oct 20 2006: 4833-4839.

**Question #3:** Biologically Equivalent dose (BED) associated with increased local control when using SBRT for lung cancer is:

- A 60
- B 80
- C 100
- D 125

**Correct answer: C**

**Rationale:** Increased local control was noted in patients who received BED>100 versus patients who received BED < 100 in Japanese SBRT series.

**References:**

Onishi H, Shirato H, Nagata Y, Hiraoka M, Fujino M, and Gomi K, et al; Hypofractionated stereotactic radiotherapy (HypoFXSRT) for stage I non-small cell lung cancer: updated results of 257 patients in a Japanese multi-institutional study. J Thorac Oncol 2007; 2(7 Suppl 3):S94-100.

**Question #4:** Regarding the relation of tumor location and grade 3-5 toxicity in lung SBRT:

- A Toxicity does not depend on tumor location
- B Toxicity is greater for central tumors
- C Toxicity is greater for peripheral tumors
- D Toxicity is greater in the lower lobe tumors than in the upper lobe tumors

**Correct answer: B**

**Rationale:** Increase in grade 3-5 toxicity was noted in 'central' tumors in university of Indiana SBRT experience

**Reference:**

Timmerman, R, McGarry, R, Yiannoutsos, C, Papiez, L, Tudor, K, DeLuca, J, Ewing, M, Abdulrahman, R, DesRosiers, C, Williams, M, and Fletcher J; Excessive Toxicity When Treating Central Tumors in a Phase II Study of Stereotactic Body Radiation Therapy for Medically Inoperable Early-Stage Lung Cancer. JCO Oct 20 2006: 4833-4839.

**Question #5:** Regarding the relationship between the local control and tumor volume in single fraction lung SBRT

- A Tumor control does not depend on the tumor volume
- B Tumor control can not be achieved by single fraction SBRT for lung tumors
- C Increased for larger tumors compared with smaller tumors
- D Increased for smaller tumors compared with larger tumors

**Correct answer: D**

**Rationale:** tumor control was higher for smaller tumors in Stanford single fraction SBRT series

**Reference:**

Loo, BW, Shen, J, Quinlan-Davidson, S, Filion, E, Dieterich, S, Maxim, PG, Wakelee, HA, Whyte, RI, and Le, Q; Tumor Size is a Critical Determinant of Local Control in Single Fraction Stereotactic Radiotherapy of Pulmonary Tumors. International Journal of Radiation Oncology Biology Physics 1 September 2008 72(1), Supplement: S467-S468

**Question #6:** Which malignancy is the leading cause of cancer deaths in women

- A Breast cancer
- B Skin cancer
- C Lung cancer
- D Colorectal cancer

**Correct answer: C**

**Rationale:** Lung cancer is the leading cause of cancer death in women (70,000 death / year) vs breast (40,000 death per year).

**Reference:**

**Cancer Statistics, 2009.** Jemal, A., Siegel, R., Ward, E., Hao, Y., Jiaquan Xu, J. and Michael J. Thun, M.J.; CA Cancer J Clin 2009 59: 225-249.

**Question #7:** Which factor was shown to be associated with increase in brachial plexopathy in patients treated with lung SBRT:

- A Use of pencil beam algorithm for dose calculations
- B Maximum brachial plexus dose >26Gy
- C Upper lobe tumors
- D Tobacco use during SBRT

**Correct answer: B**

**Rationale:** Incidence of brachial plexopathy was increased in patients who received >26 Gy maximum dose to brachial plexus.

**Reference:**

Forquer JA, Fakiris AJ, Timmerman RD, Lo SS, Perkins SM, McGarry RC, and Johnstone PA; Brachial plexopathy from stereotactic body radiotherapy in early-stage NSCLC: Dose-limiting toxicity in apical tumor sites. Radiother Oncol. 2009 Dec;93(3):408-13. Epub 2009 May 18)

**Question #8:** Which of the following toxicity is not commonly associated with lung SBRT

- A Pneumonitis
- B Rib fracture
- C Chest wall pain
- D Coronary artery disease

**Correct answer: D**

**Rationale:** Pneumonitis, chest wall pain, and rib fractures were all noted in SBRT trials, while coronary artery disease was not.

**Reference:**

Timmerman, R, McGarry, R, Yiannoutsos, C, Papiez, L, Tudor, K, DeLuca, J, Ewing, M, Abdulrahman, R, DesRosiers, C, Williams, M, and Fletcher J; Excessive Toxicity When Treating Central Tumors in a Phase II Study of Stereotactic Body Radiation Therapy for Medically Inoperable Early-Stage Lung Cancer. JCO Oct 20 2006: 4833-4839.

**Question #9** Which of the following factors is associated with 50% probability of rib fracture?

- A Tumor volume adjacent to more than one rib
- B Underlying history of osteoporosis
- C Dose to 2 cm<sup>3</sup> of rib volume > 50Gy
- D Female gender

**Correct answer: C**

**Rationale:** Dose to 2 cm<sup>3</sup> of rib tissue was related to probability of rib fracture and was noted to be about 50% when D2cm<sup>3</sup> exceeded 50 Gy

**Reference:**

Pettersson et al; Radiation-induced rib fractures after hypofractionated stereotactic body radiation therapy of non-small cell lung cancer: A dose- and volume-response analysis. *Radiother Oncol.* 2009 Jun;91(3):360-8. Epub 2009 May 4

**Question #10:** The use of tissue heterogeneity correction in the lung SBRT:

- A Has no impact on the accuracy of dose calculation
- B Should not be used in lung SBRT
- C Results in different dose distribution compared with un-corrected plans
- D Results in less accurate isodose plans

**Correct answer: C**

**Rationale:** the use of heterogeneity correction demonstrates different dose distribution (and potentially more accurate) compared with un-corrected plans

**Reference:**

Xiao, Y, Papiez, L, Paulus, R, Timmerman, R, Straube, WL, Bosch, WR, Michalski, J, and Galvin, JM; Dosimetric Evaluation of Heterogeneity Corrections for RTOG 0236: Stereotactic Body Radiotherapy of Inoperable Stage I-II Non-Small-Cell Lung Cancer. *International Journal of Radiation Oncology \* Biology \* Physics* 15 March 2009 Vol. 73(4):1235-1242