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1. Selecting appropriate patients for SBRT
2. Prescription / SBRT lung Protocols
3. Problems with target identification (use of multi-modality imaging)
4. OAR Tolerances: V20, chest wall, etc
5. Physician thoughts on balancing OAR and Desired Rx



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### High level thoughts on SBRT

- *Convenience Vs Superiority*
- *Does it work? Heisenberg's uncertainty principle*



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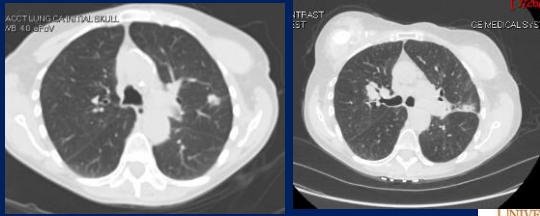
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# How do we evaluate response?



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# Selecting Appropriate Patients for SBRT

- Peripheral lesions
- Central lesions
- DEATHS FROM IPF

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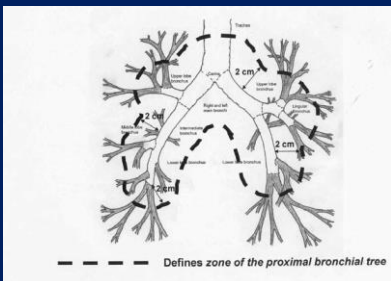
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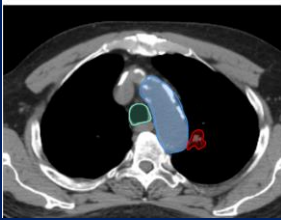
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## Peripheral or Central



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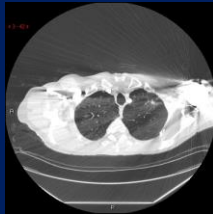
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## Peripheral lesion



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NRG ONCOLOGY

RTOG 0915  
(NCCTG N0927)

A RANDOMIZED PHASE II STUDY COMPARING 2 STEREOTACTIC BODY RADIATION THERAPY (SBRT) SCHEDULES FOR MEDICALLY INOPERABLE PATIENTS WITH STAGE I PERIPHERAL NON-SMALL CELL LUNG CANCER

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## RTOG 0915 Eligibility Criteria

- Histological confirmation (by biopsy or cytology) of non-small cell lung cancer (NSCLC) prior to treatment; the following primary cancer types are eligible: squamous cell carcinoma,
- adenocarcinoma, large cell carcinoma, large cell neuroendocrine, or non-small cell carcinoma
- not otherwise specified; **Note:** although bronchioalveolar cell carcinoma is a subtype of NSCLC, patients with the pure type of this malignancy are excluded from this study because
- the spread of this cancer between adjacent airways is difficult to target on CT.
- Stage T1, N0, M0 or T2 ( $\leq 5$  cm), N0, M0

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## RTOG 0813

NRG ONCOLOGY  
RTOG 0813

SEAMLESS PHASE III STUDY OF STEREOTACTIC LUNG RADIOTHERAPY (SBRT)  
FOR EARLY STAGE, CENTRALLY LOCATED,  
NON-SMALL CELL LUNG CANCER (NSCLC) IN MEDICALLY INOPERABLE PATIENTS

Limited Participation Study: See Section 5.0

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## RTOG 0813 Eligibility Criteria

- Tumor within or touching the zone of the proximal bronchial tree.
- Tumors that are immediately adjacent to mediastinal or pericardial pleura (PTV touching the pleura).

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# Prescription / SBRT lung Protocols

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## RTOG 0915

- Arm 1 patients will receive 34 Gy in 1 fraction to the prescription line at the edge of the PTV
- Arm 2 patients will receive 4 fractions, 12 Gy per fraction, to a total dose of 48 Gy to the prescription line at the edge of the PTV.
- Treatments should be given on 4 consecutive days.
- The time between fractions is at the discretion of the investigator, but a minimum of 18 hours

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## RTOG 0813

RTOG 0813  
Seamless Phase III Study of Stereotactic Lung Radiotherapy (SBRT) for Early Stage, Centrally Located, Non-Small Cell Lung Cancer (NSCLC) in Medically Inoperable Patients

### SCHEMA

Escalating dose levels; at all levels, patients will receive q 2 day fractionation X 5 fractions over 1.5-2 weeks

Dose Level	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Level 9
Dose per Fraction	8 Gy	8.5 Gy	9 Gy	9.5 Gy	10 Gy	10.5 Gy	11 Gy	11.5 Gy	12 Gy
Total Dose	40 Gy	42.5 Gy	45 Gy	47.5 Gy	50 Gy	52.5 Gy	55 Gy	57.5 Gy	60 Gy

\*Protocol treatment begins at Level 5. Levels 1-4 will be employed if dose-limiting toxicity is seen with the Level 5 (10 Gy) starting dose.  
See Section 5.0 for pre-registration requirements; see Section 6.0 for details of radiation therapy planning and delivery.

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# OAR Tolerances: V20, chest wall, etc

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# RTOG 0915

(111)2) Arm 2: Four Fractions (4 x 12 Gy)

Serial Tissue	Volume	Volume Max (Gy)	Max Point Dose (Gy)	Endpoint (≥Grade 3)
Spinal Cord	<0.35 cc	20.8 Gy (5.2 Gy/fx)	26 Gy (6.5 Gy/fx)	myelitis
	<1.5 cc	13.8 Gy (3.4 Gy/fx)		
Esophagus*	<5 cc	18.8 Gy (4.7 Gy/fx)	20 Gy (5 Gy/fx)	stenosis/fistula
Brachial Plexus	<3 cc	23.8 Gy (5.9 Gy/fx)	27.2 Gy (6.8 Gy/fx)	neuropathy
Heart/Pericardiu	<15 cc	28 Gy (7 Gy/fx)	34 Gy (8.5 Gy/fx)	pericarditis
m				
Great vessels	<10 cc	43 Gy (10.75 Gy/fx)	49 Gy (12.25 Gy/fx)	aneurysm
Trachea and	<4 cc	15.8 Gy (3.9 Gy/fx)	34.8 Gy (8.7 Gy/fx)	stenosis/fistula
Large Bronchus*				
Rib**	<1 cc	32 Gy (8 Gy/fx)	40 Gy (10 Gy/fx)	Pain or fracture
Skin	<10 cc	33.2 Gy (8.3 Gy/fx)	38 Gy (9.5 Gy/fx)	ulceration
Stomach	<10 cc	17.4 Gy (4.4 Gy/fx)	27.2 Gy (6.8 Gy/fx)	ulceration/fistula
Parallel Tissue	Critical Volume (cc)	Critical Volume Dose Max (Gy)		Endpoint (≥Grade 3)
Lung (Right & Left)	1500 cc	11.6 Gy (2.9 Gy/fx)		Basic Lung Function
Lung (Right & Left)	1000 cc	12.4 Gy (3.1 Gy/fx)		Pneumonitis

\*Avoid circumferential irradiation  
 \*\*Rib limit may be exceeded if rib structure lies within PTV; see Section 6.5.1.1 below.

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# RTOG 0915

Arm 1: One Fraction (24 Gy)

Serial Tissue	Volume	Volume Max (Gy)	Max Point Dose (Gy)	Endpoint (≥Grade 3)
Spinal Cord	<0.35 cc	10 Gy	14 Gy	myelitis
	<1.2 cc	7 Gy		
Esophagus*	<5 cc	11.9 Gy	15.4 Gy	stenosis/fistula
Brachial Plexus	<3 cc	16 Gy	17.5 Gy	neuropathy
Heart/Pericardiu	<15 cc	18 Gy	22 Gy	pericarditis
m				
Great vessels	<10 cc	31 Gy	37 Gy	aneurysm
Trachea and	<4 cc	10.3 Gy	20.2 Gy	stenosis/fistula
Large Bronchus*				
Rib**	<1 cc	22 Gy	30 Gy	Pain or fracture
Skin	<10 cc	25 Gy	28 Gy	ulceration
Stomach	<10 cc	11.2 Gy	12.4 Gy	ulceration/fistula
Parallel Tissue	Critical Volume (cc)	Critical Volume Dose Max (Gy)		Endpoint (≥Grade 3)
Lung (Right & Left)	1500 cc	7 Gy		Basic Lung Function
Lung (Right & Left)	1000 cc	7.4 Gy		Pneumonitis

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# RTOG 0813

**Table 3**

Serial Tissue*	Volume	Volume Max (Gy)	Max Point Dose (Gy)	Avoidance Endpoint
Esophagus, non-adjacent wall	<5 cc	27.5 Gy (5.5 Gy/fx)	105% of PTV prescription	stenosis/fistula
Heart/Pericardium	<15 cc	32 Gy (6.4 Gy/fx)	105% of PTV prescription	pericarditis
Great vessels, non-adjacent wall	<10 cc	47 Gy (9.4 Gy/fx)	105% of PTV prescription	aneurysm
Trachea and ipsilateral bronchus, non-adjacent wall	<4 cc	18 Gy (3.6 Gy/fx)	105% of PTV prescription	stenosis/fistula

\*The volume maximum column shows suggested limits for these structures for planning purposes. Exceeding these limits is not a protocol violation. However, exceeding the Maximum Point Dose column is a violation per Section 6.7.2.

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# OAD Tolerances: V20, chest wall, etc

**Table 2**

Serial Tissue	Volume	Volume Max (Gy)	Max Point Dose (Gy)	Avoidance Endpoint
Spinal Cord	<0.25 cc	22.5 Gy (4.5 Gy/fx)	30 Gy (6 Gy/fx)	myelitis
Ipsilateral Brachial Plexus	<0.5 cc	13.5 Gy (2.7 Gy/fx)	32 Gy (6.4 Gy/fx)	neuropathy
Skin	<10 cc	30 Gy (6 Gy/fx)	32 Gy (6.4 Gy/fx)	ulceration
<b>Parallel Tissue</b>	<b>Critical Volume</b>	<b>Critical Volume Dose Max (Gy)</b>		<b>Avoidance Endpoint</b>
Lung (Right & Left)	1500 cc	12.5 Gy (2.5 Gy/fx)		Basic Lung Function
Lung (Right & Left)	1000 cc	13.5 Gy (2.7 Gy/fx)		Pneumonitis

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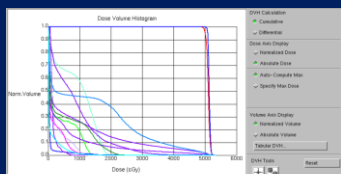
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**RTO Statistics**

Serial Tissue	Total cc	Mean	Max	Mean	Std Dev	% > 100%	Comments
Overall	1500	4969.0	1013.8	1794.4	839.9	0.0%	
Lung, L	124	5098.0	797.1	1276.9	839.9	0.0%	
Lung, R	121	1702.1	198.2	288.4	839.9	0.0%	
PTV	4999.0	5248.7	5248.7	811.1	839.9	0.0%	
Lung-PTV	124	4318.0	428.9	811.1	839.9	0.0%	
Esophagus	118.0	2629.8	267.2	384.9	839.9	0.0%	
Heart/Pericardium	113.1	3766.1	1394.9	1534.2	839.9	0.0%	
Skin	78.2	1722.4	198.2	192.0	839.9	0.0%	



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PDR	Primary Goal				Secondary Goal				Volume of Primary Goal Dose	Result	
	Type	Dose City	Dose Volume	Dose City	Dose Volume	Dose City	Dose Volume				
Lungp-1V	Max DVH(Dose)	10000	10	%	20000	10	%	5318.0	Max	6.346	100%
Lungp-1V	Max DVH(Dose)	12500	1000	ccr3	2	0	ccr3	5318.0	Max	453.800	ccr3
Lungp-1V	Max DVH(Dose)	13000	1000	ccr3	2	0	ccr3	5318.0	Max	288.729	ccr3
SomafCard	Max DVH(Dose)	22500	0.425	ccr3	0	0	ccr3	1827.7	Max	0.000	ccr3
SomafCard	Max DVH(Dose)	13000	0.65	ccr3	0	0	ccr3	1827.7	Max	0.487	ccr3
SomafCard	Max Dose	30000			0			1827.7	Max		
SpinalNerve_1	Max DVH(Dose)	30000	2	ccr3	0	0	ccr3	751.3	Max	0.000	ccr3
SpinalNerve_2	Max Dose	30000			0			751.3	Max		
skin	Max DVH(Dose)	30000	10	ccr3	0	0	ccr3	1723.4	Max	0.000	ccr3
skin	Max Dose	30000			0			1723.4	Max		
HeartLungs	Max DVH(Dose)	27500	0	ccr3	2	0	ccr3	2480.0	Max	0.000	ccr3
HeartLungs	Max Dose	27500			2			2480.0	Max		
Heart	Max DVH(Dose)	20000	15	ccr3	2	0	ccr3	2270.1	Max	0.000	ccr3
Heart	Max Dose	20000			2			2270.1	Max		
GoodHeart	Max DVH(Dose)	40000	10	ccr3	2	0	ccr3	5154.1	Max	0.483	ccr3
GoodHeart	Max Dose	40000			2			5154.1	Max		
Trachea x PFT	Max DVH(Dose)	14000	4	ccr3	2	0	ccr3	2102.6	Max	1.238	ccr3
Trachea x PFT	Max Dose	14000			2			2102.6	Max		
Diaphragm	Max DVH(Dose)	30000	30	ccr3	0	0	ccr3	8840.0	Max	13.409	ccr3



Horizontal lines for notes

## Physician thoughts on balancing OAR and Desired Rx

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Horizontal lines for notes

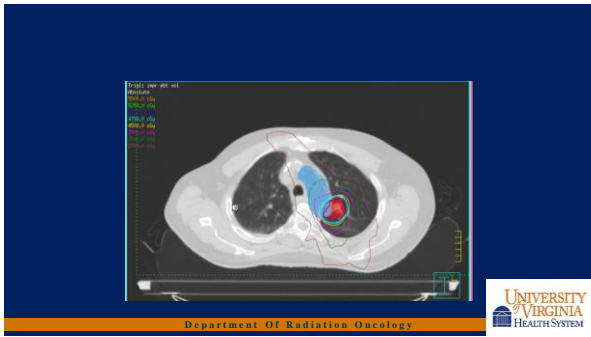
## Simultaneous Integrated Protection Crane MSKCC

**Fig 5.** Radiation treatment plan illustrating the simultaneous integrated boost technique. A dose of 100Gy in 25 fractions is delivered to the contour of the tumor (dark blue contour) while the gross tumor volume (GTV) receives 50 Gy in 25 fractions (red contour). The GTV does not overlap with the sparing risk volume (PRV), created by a 5-mm expansion of at-risk organs at risk for GPT. For treatment planning, the organ at risk is the priority contour over the sparing target volume (PTV). A microscopic dose of 85 Gy, which is within the tolerance of the parotid mucosa, is delivered to the whole tumor with margin as the PTV 85 Gy (light blue contour).

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Horizontal lines for notes





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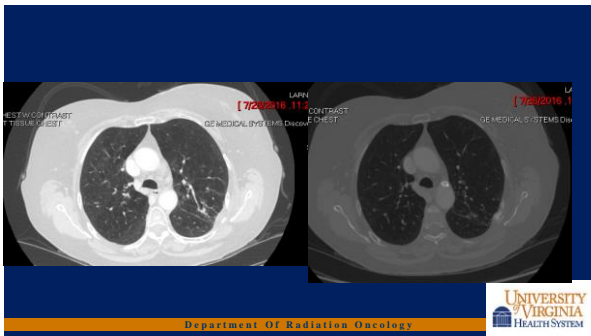
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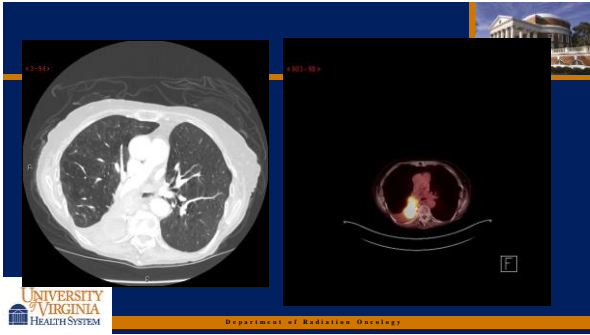
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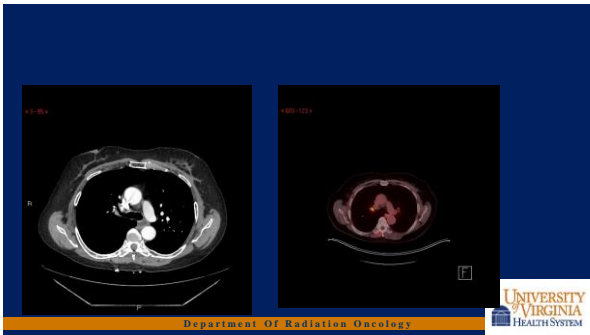
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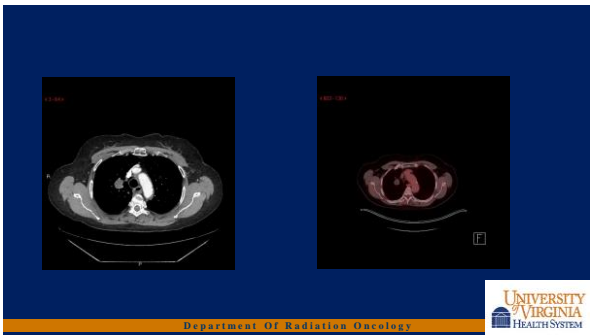
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# Polling Questions

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Text **aapm2016** to  
**22333**

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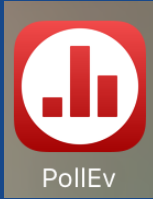
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Step 1: Download Poll Everywhere from your App Store  
Then Open App



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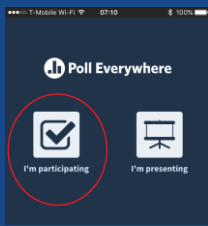
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Step 2: Select "I'm Participating"



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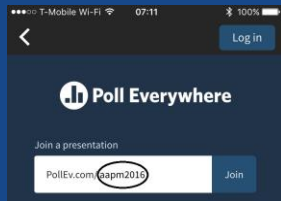
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Step 3: "Join a presentation"

Username: **aapm2016**



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If Apps aren't available to you...

Use a Web Browser



<https://www.pollev.com/aapm2016>

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