

# The Role of Radiotherapy in Modern Lung Cancer Treatment

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# Disclosures

- None

# Objectives

- 1) List 3 potential indications for radiotherapy in the management of lung cancer
- 2) Understand what is involved in Stereotactic Body Radiotherapy and why it is used
- 3) Identify common lung cancer radiation toxicities and their management

# Case 1

- 77F with prior lung cancer
  - Stage I NSCLC (T1N0): RUL lobectomy (2004)
- PMHx:
  - Ex-smoker with a 60 PYHx
  - COPD (no supplemental O<sub>2</sub>)
  - CAD (2 stents), HTN, DM2, ↑cholesterol
  - ECOG Performance status = 1
- PFTs: FEV1 = 0.9 litres, DLCO = 40% predicted

# Case 1 – Cont'd

- Follow-up CXR: new Right lung nodule
- CT chest: new, spiculated right lung nodule suspicious for malignancy
- PET scan:
  - Right lung nodule (SUV = 26) highly suspicious for malignancy.
  - No nodal or distant metastases suspected

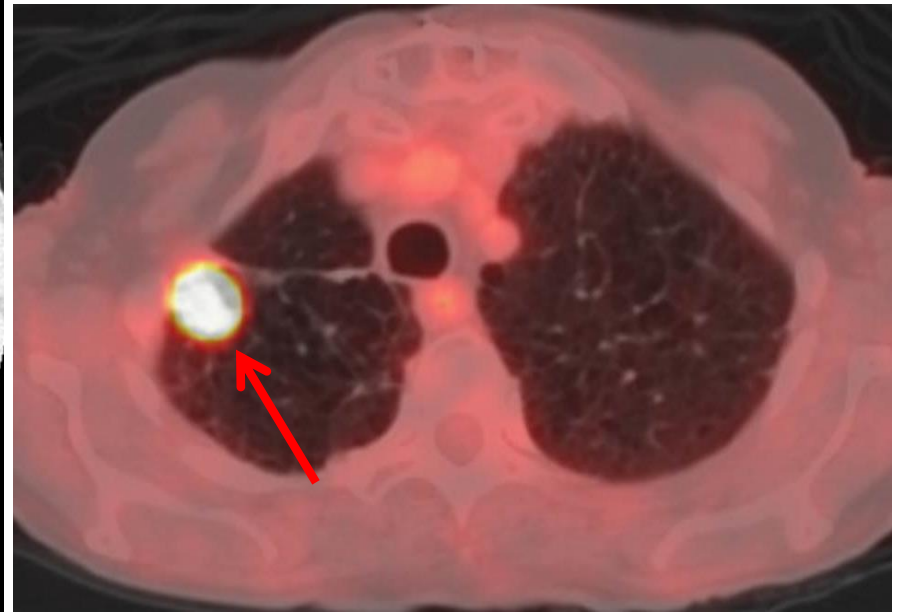
# Case 1: Continued...

CT Chest



1.7 x 1.1 cm tumour

PET



SUV = 26.3

# Case 1 – Cont'd

What is your next course of action?

- A) Ask a thoracic surgeon for an opinion regarding resection
- B) Ask interventional radiology to consider a biopsy
- C) Observe with serial imaging scans
- D) Send to Radiation Oncology for consideration of radical Stereotactic Body Radiotherapy (SBRT)
- E) Bug me later, I haven't had coffee yet...

# Case 1 - Cont'd

- **Thoracic surgeon:**
  - “Considerable comorbidities and advanced age puts her at high perioperative risk”
  - “Not a good candidate for surgical resection”



# Case 1 - cont'd

## Interventional Radiology:

- “Location of tumour close to fissure & bullae puts the patient at high risk of pneumothorax”
- “Imaging appearances are in keeping with a primary lung malignancy”
- “CT guided biopsy is not recommended”

# Case 1 – Cont'd

## Rad Onc Assessment

- Good performance status
- Still independent
- Biopsy not feasible
  - Brought to Thoracic DSG rounds for discussion
    - Consensus recommendation was for SBRT lung

# Stereotactic Body Radiotherapy (SBRT)

- What:
  - New treatment modality (2014)
  - Highly conformal ablative doses of RT to tumours
  - Cutting edge RT imaging/planning/delivery
  - “Game Changer”:
    - Very well tolerated
    - Excellent local control (~90%)
    - Convenient schedules of 3 to 8 fractions

# Stereotactic Body Radiotherapy (SBRT)

- Who:
  - Patients who are inoperable or decline surgery
    - Advanced age (no defined upper age limit)
    - Considerable comorbidities (COPD, CAD)
      - Poor pulmonary function:
      - High anesthesia risk
  - Requirements:
    - T1-T2 (<5cm)N0 NSCLC or metastasis (Biopsy Preferred)
    - Non-oxygen dependent at rest
    - Still functional at home, ECOG  $\leq 2$
    - Able to lie supine and flat/still for ~30 mins
    - “Minimum” FEV1 = 0.8L; “Minimum” DLCO = 35%

# Stereotactic Body Radiotherapy (SBRT)

- Where:
  - CCMB MacCharles
  - KIAM (HSC) “Edge”
  - WMCC – TBD

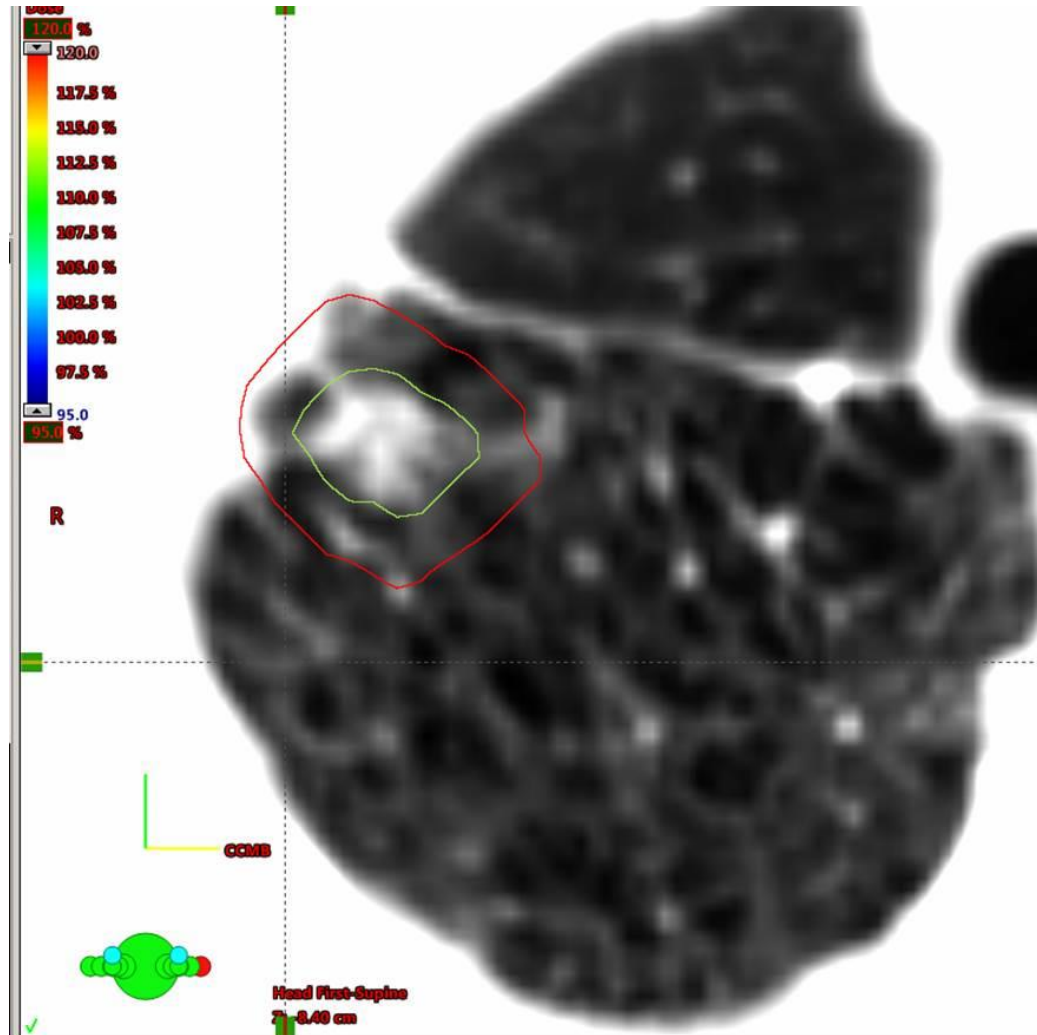


# Stereotactic Body Radiotherapy (SBRT)

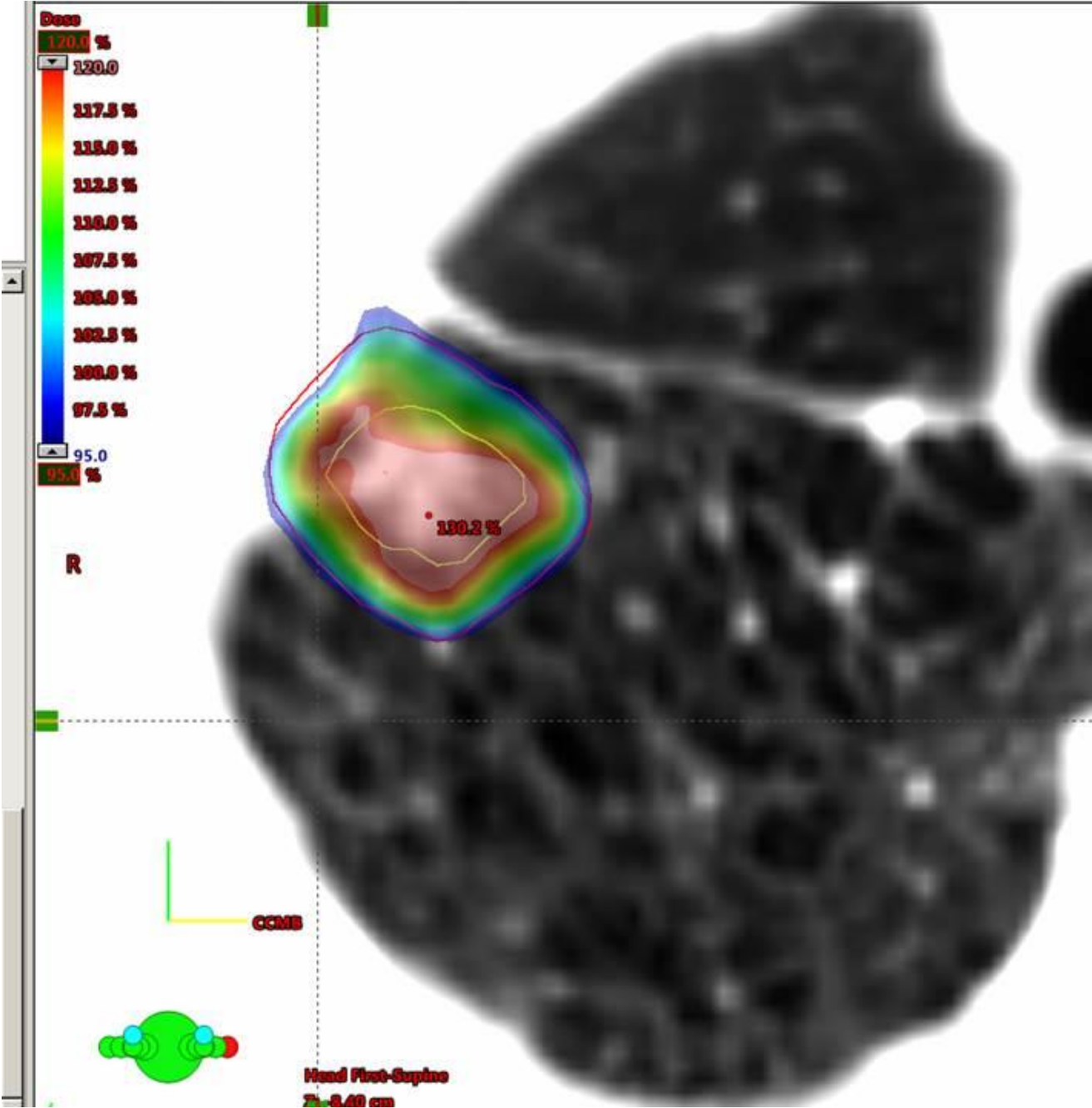
- How
  - “Mock setup”
  - 4DCT simulation scan (free breathing)
    - Respiratory phase correlated CT data sets
  - Treatment planning (7-10 days)
  - SBRT treatment:
    - 3 to 8 fraction course
    - Free breathing
    - Each fraction takes 30-45 mins
      - Treatment setup takes 15-30 min
      - Actual RT takes 4-5 minutes per fraction

# Case 1 – Cont'd

ITV = Green  
PTV = Red

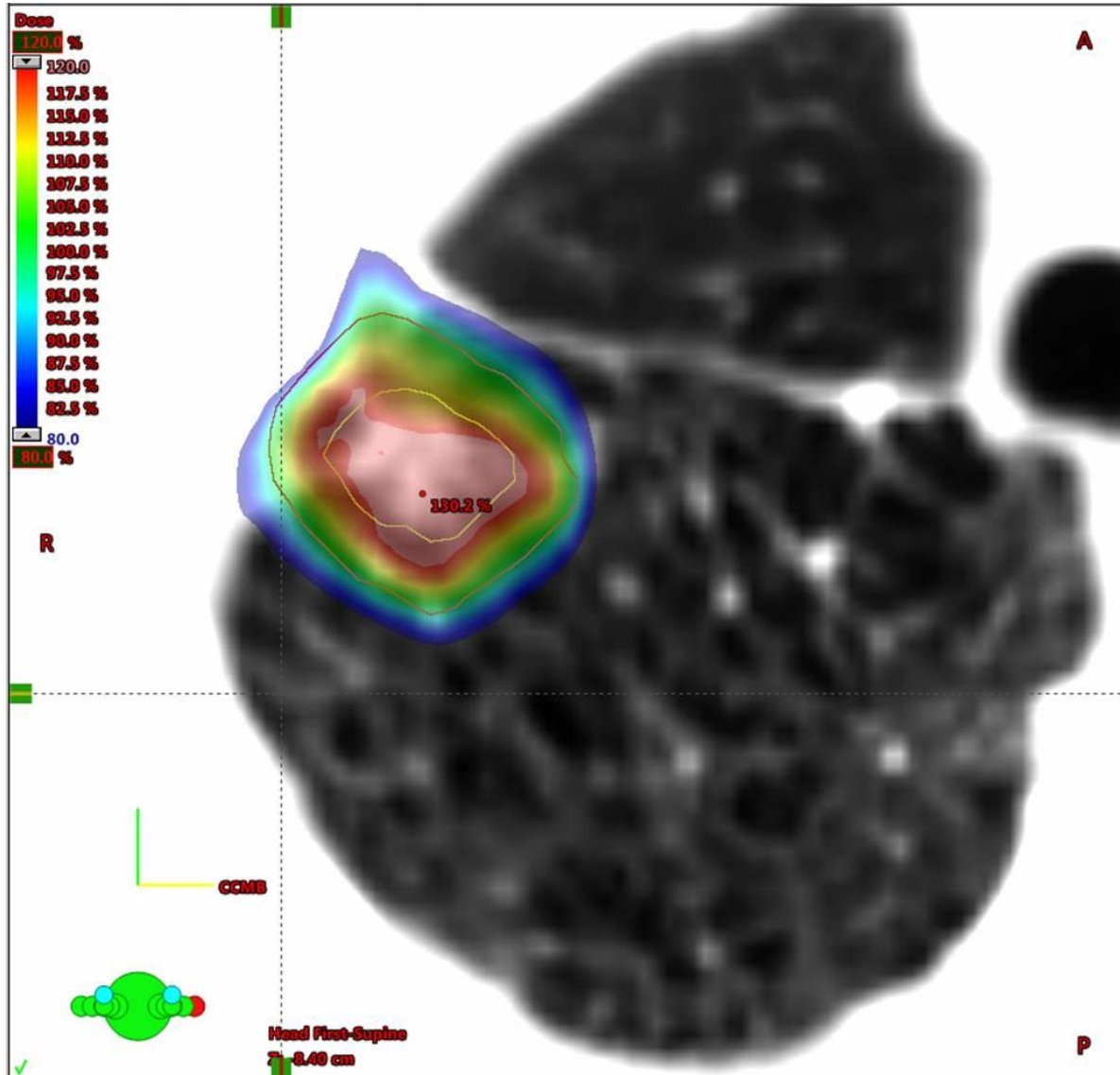


95% isodose

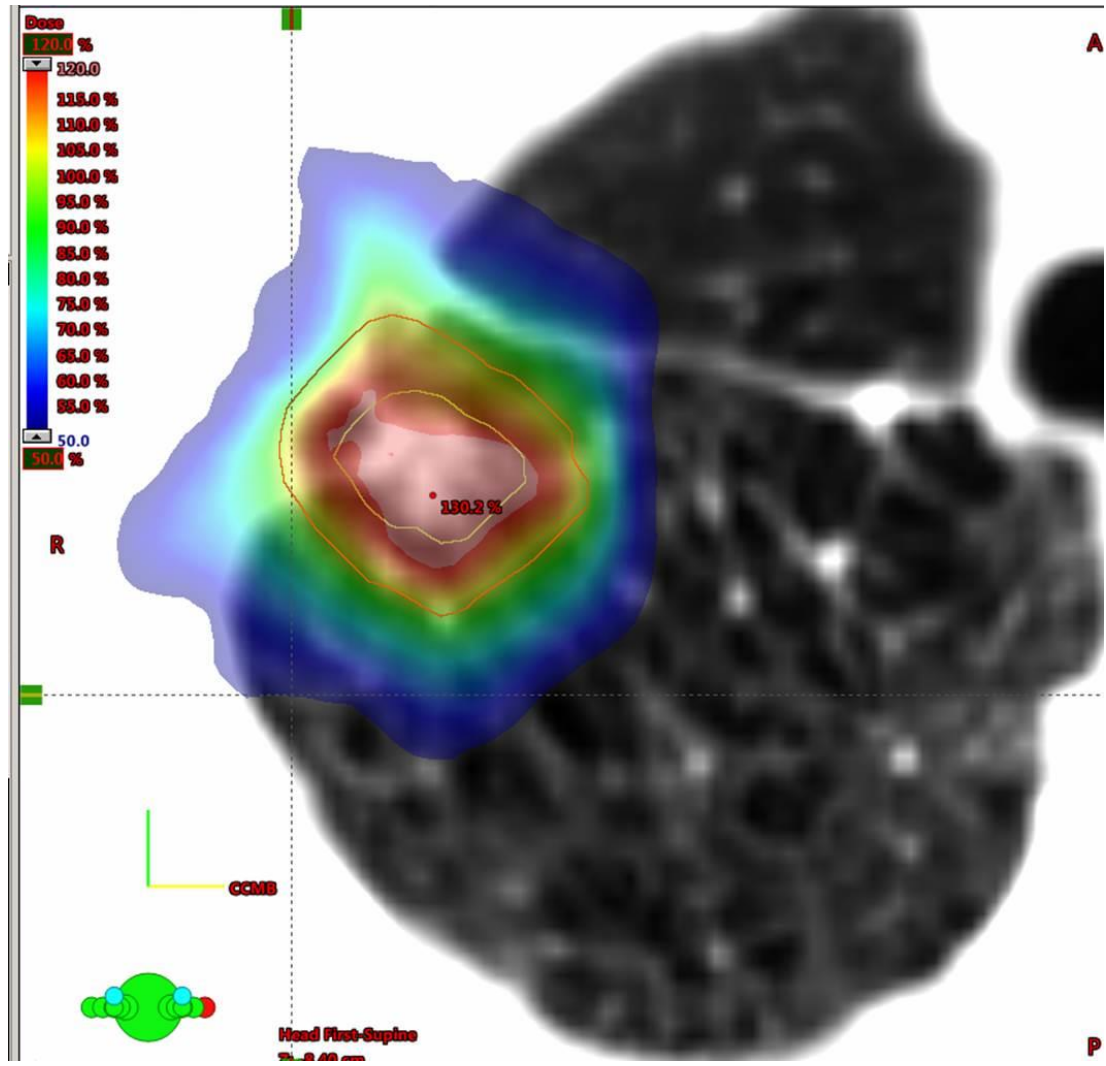




80% isodose



50% isodose



# SBRT tolerability

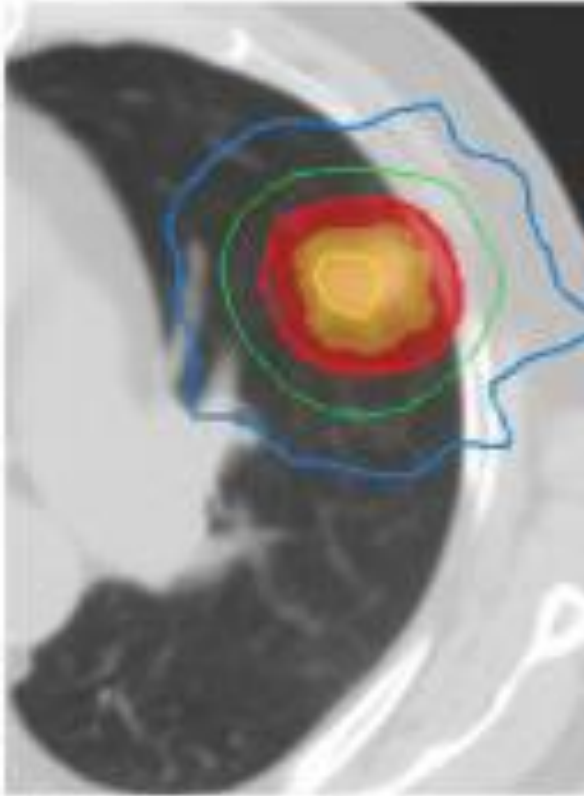
- Generally very well tolerated
- Toxicity depends on location

Acute Toxicity (typically G1-2)	Late Toxicity
Fatigue	Rib fracture
chest wall discomfort	Pulmonary Fibrosis (localized)
Dry skin	Secondary malignancy (rare)
Pneumonitis (rare)	

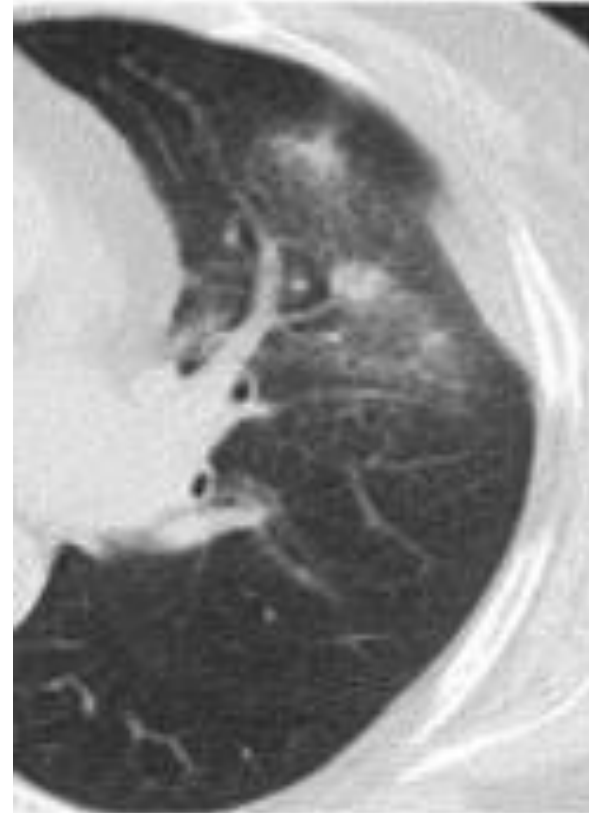
# SBRT Toxicity

- Radiation Pneumonitis
  - Relatively rare issue with modern SBRT techniques
  - Inflammation of lung from RT; causes lungs to make less surfactant
  - Classically presents 6 weeks post RT
  - Dry cough, fatigue, SOB/OE, malaise, fever possible
  - O/E: ↓O<sub>2</sub> sat, ↑ WOB
  - Management depends on severity

# Pneumonitis



**SBRT Plan**



**F/U CT**

# Radiation Pneumonitis Cont'd

Grade	Definition	Risk <sup>1</sup>	Management
1	Asymptomatic (DI finding only)	8%	Conservative
2	Persistent Dry Cough Limits iADLs	7%	PO Prednisone (Outpatient)
3	Persistent Dry Cough Limits ADLs Hypoxia	2%	Dex, O <sub>2</sub> (Admission)
4	Life threatening hypoxia	0.4%	Dex Intubation, ICU

Note: \*\*\*Risk is almost certainly overestimated given obsolete SBRT techniques used in this study's period\*\*\*

<sup>1</sup>Barringer, B et al. IJROBP, Vol 82 (1), Jan 2012

# SBRT - Summary

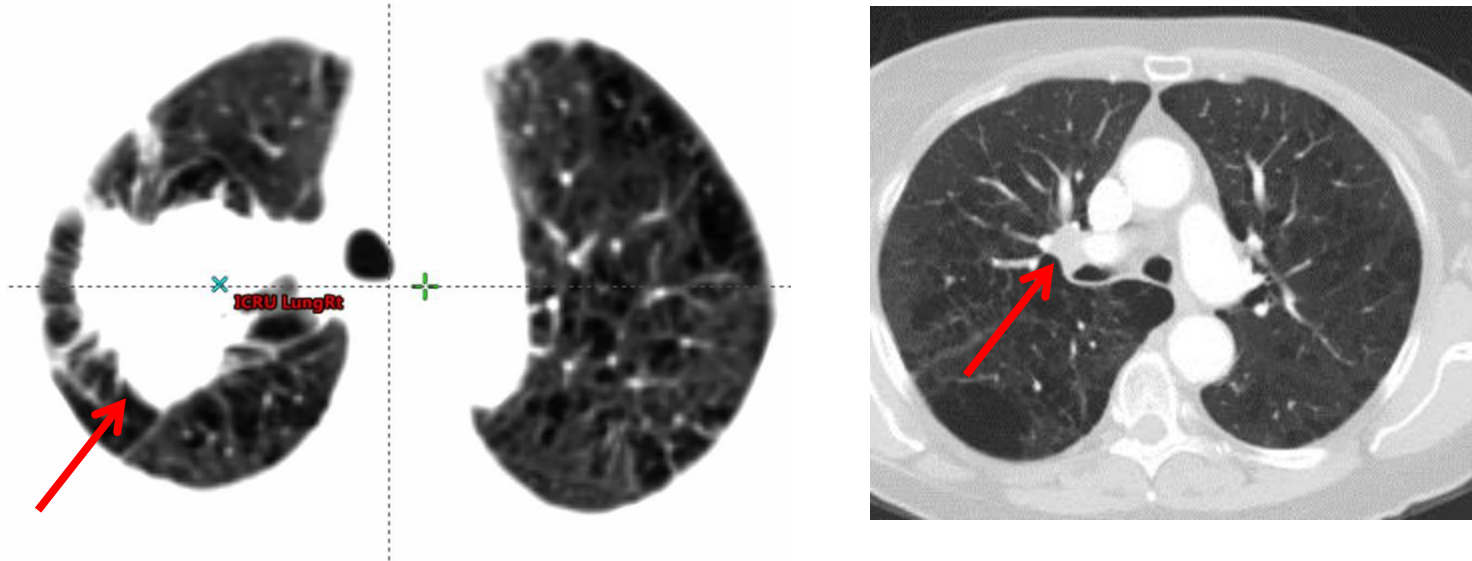
- “Game Changer”
  - T1-2N0 NSCLC or Metastasis
  - Biopsy preferred, but not always necessary
  - Comorbidities/inoperable/poor PFTs/elderly OK
  - Very well tolerated, convenient
  - High local control
  - Pneumonitis is possible, but very rarely severe

# Case 2

- 71F, retired warehouse worker
  - Current smoker with 60 PYH
- PMH:
  - DM2, HTN, MI (2010), COPD
  - Early stage Breast Ca
- Followed by Respiriology
  - Routine F/U CXR showed R lung apex lesion
  - CT Chest ordered



# CT chest



- Emphysematous changes
- 8.0 x 6.4 x 6.6 cm RUL tumour
- Enlarged R hilar LNs
- Sub cm mediastinal LNs

# What is your next step?

- A) Refer to Thoracic Surgery?
- B) Refer to interventional radiology for a CT guided Biopsy?
- C) Refer to CCMB for further Management?
- D) Order a PET scan?
- E) Undecided, Its really early in the AM

# What is your next step?

A) Refer to Thoracic Surgery?

## Case 2 – Cont'd

- Assessed by Thoracic Surgery
- PFT's: FEV1 = 1.65L, DLCO 55% predicted
- Bronchoscopy:
  - RUL biopsy: Adenocarcinoma
- Not an operative candidate due to comorbidities
- Ordered PET

## Case 2 – Cont'd

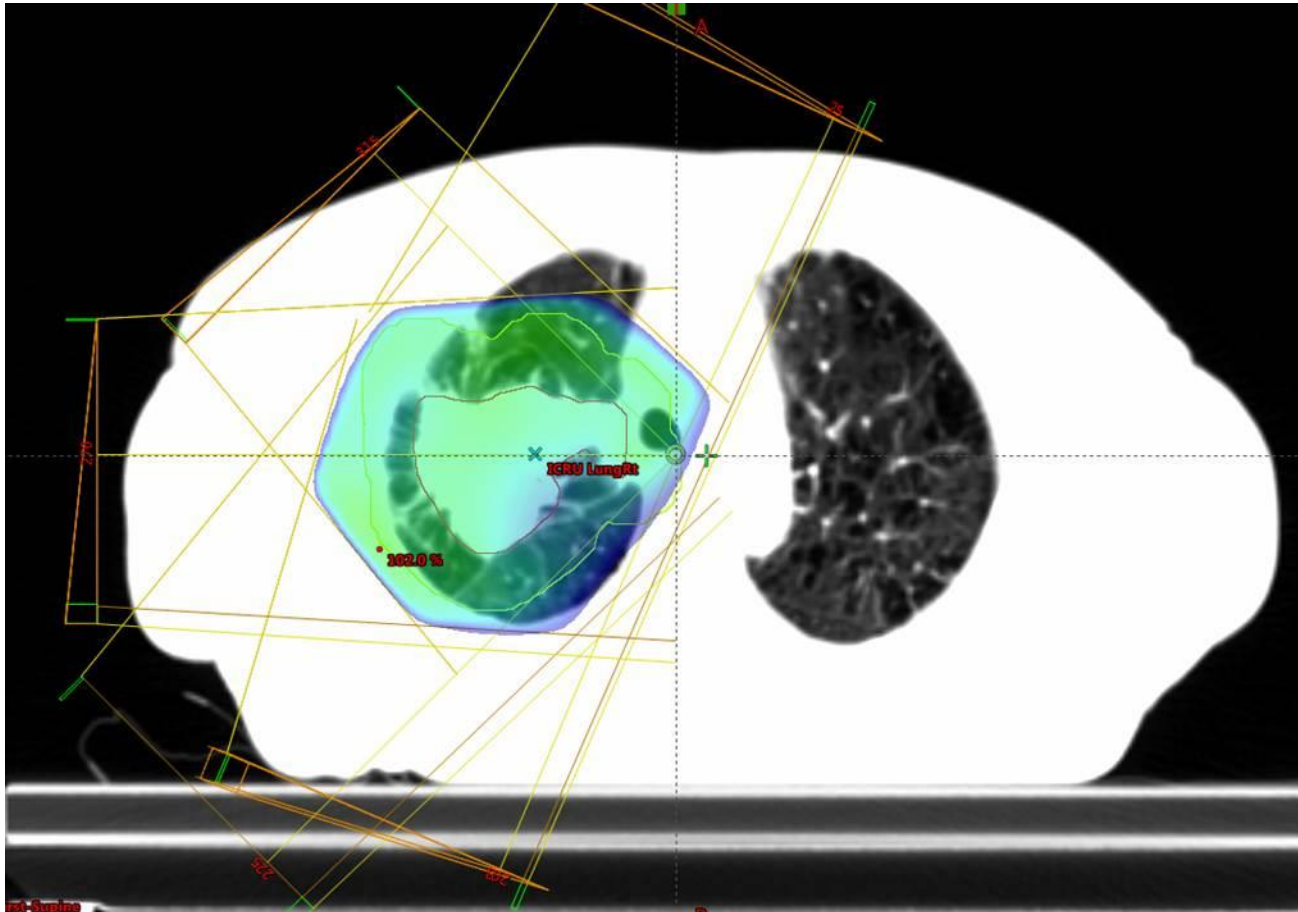


- PET:
  - RUL tumour (SUV 17.6)
  - R hilar LN (SUV 3.4)
  - No distant mets

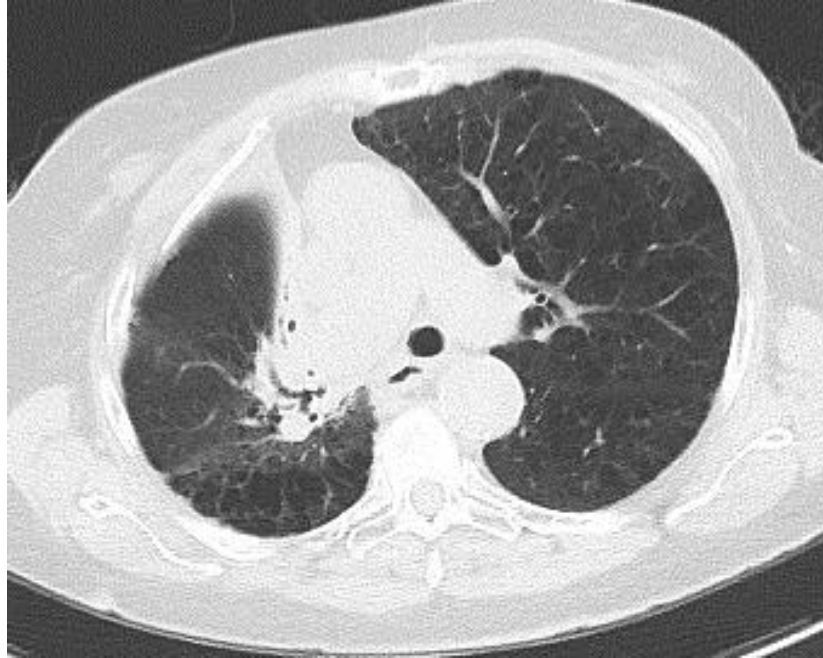
# Case 2 - Management

- T3N1M0 NSCLC (adenoca)
  - Stage IIIA (Inoperable)
- Assessed by RO and MO
  - Radical concurrent chemoradiotherapy (CRT)
  - RT: 66Gy/33 fractions 3D conformal radiotherapy
  - Chemo: weekly carboplatin + paclitaxel

# 3D Conformal RT



# Outcomes



5 Yr OS = 32%



# Acute Adverse Effects

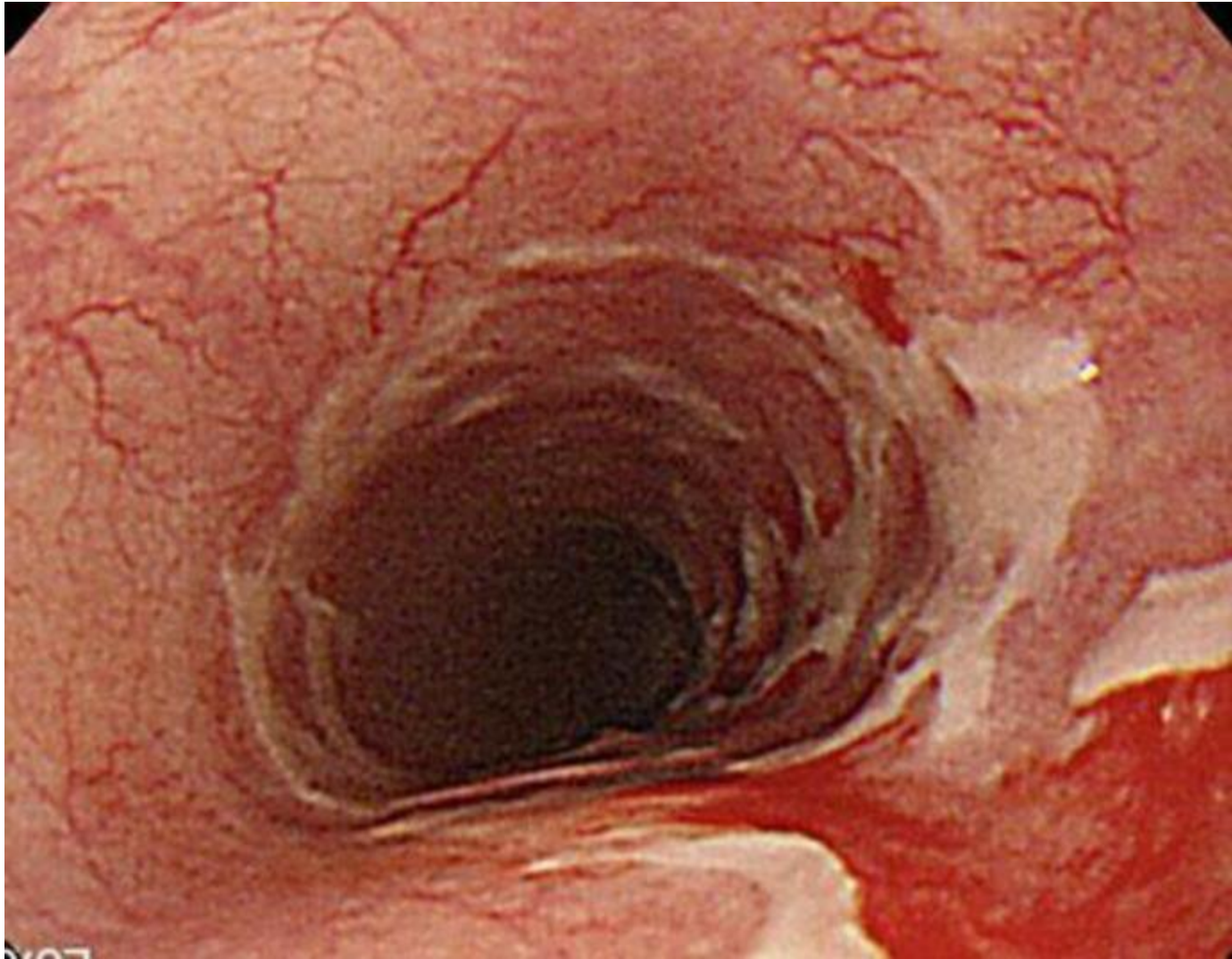
Adverse Effect	Frequency	Management
Fatigue	Cumulative & common	Rest
Pneumonitis	15-20%	Grade dependent
Chest wall discomfort	10%	Supportive
Esophagitis	Location dependent (30-40% of pts with mediastinal disease)	See Next Slide

# Esophagitis

- Most common local acute toxicity of CRT
  - Mediastinal or Hilar LN
- Onset midway during CRT course
- Mechanism:
  - mucosal inflammation and epithelial thinning
  - denudation and ulceration
  - Sloughing of cells can make for candidiasis
- Generally self limiting

# Esophagitis

- Symptoms:
  - Sensation of heartburn
  - Odynophagia
  - Exacerbated by PO intake (Hot foods/ETOH)
- O/E: may have signs of thrush in oropharynx



Miura, Y. Case Reports in Oncology. Vol 6(2), May 2013

# Esophagitis Management

- Supportive interventions:
  - Liquid Analgesics
  - Acid Suppression (PPI)
  - Dietary Modification (Nutrition consult)
    - Avoid spicy or hot foods
    - Avoid EtOH
  - “Magic Mouthwash” to swish & swallow
    - Xylocaine + Antacid + Antifungal + ATBX + Steroid

# Case 2 Summary

- Concurrent CRT is used for stage III NSCLC
- Outcomes slowly improving
- “Marathon”
  - Supportive care is key to having pts finish
  - Toxicity is typically self limiting

# Case 3

- 60F with known metastatic NSCLC (liver mets)
  - Prior palliative systemic therapy
    - 1<sup>st</sup> line cisplatin/pemetrexed (4 cycles)
    - 2<sup>nd</sup> line erlotinib (3 months)
    - 3<sup>rd</sup> line nivolumab
- HPI: Walks into her CCPN with:
  - 1 wk hx of progressive mid back pain requiring T3s
  - No falls
  - No bowel or bladder incontinence
- O/E:
  - Still ambulatory
  - No focal neurological weakness, no loss of sensation
  - Significant pain on percussion of spine

# What do you do next?

- A) X-ray spine?
- B) CT Spine?
- C) MRI Spine?
- D) Send to tertiary care center for NS consult?
- E) Call the on call RO for assessment?



# T1



# T2



- Multilevel vertebral body metastases (T7, T8, T9-10)
- Mild spinal canal narrowing
- No significant spinal cord compression

# Case 3 Cont'd

## RO assessment on call

- No clinical evidence of spinal cord comp
- Uncomplicated bone metastasis
- Caveat: pt was on nivolumab 1 week ago
- Plan:
  - CT sim
  - Intentional 1 wk delay prior to
  - Palliative RT (8Gy/1 fraction)



Is 8Gy in 1 fraction enough?

# Single vs. Multiple Fraction RT

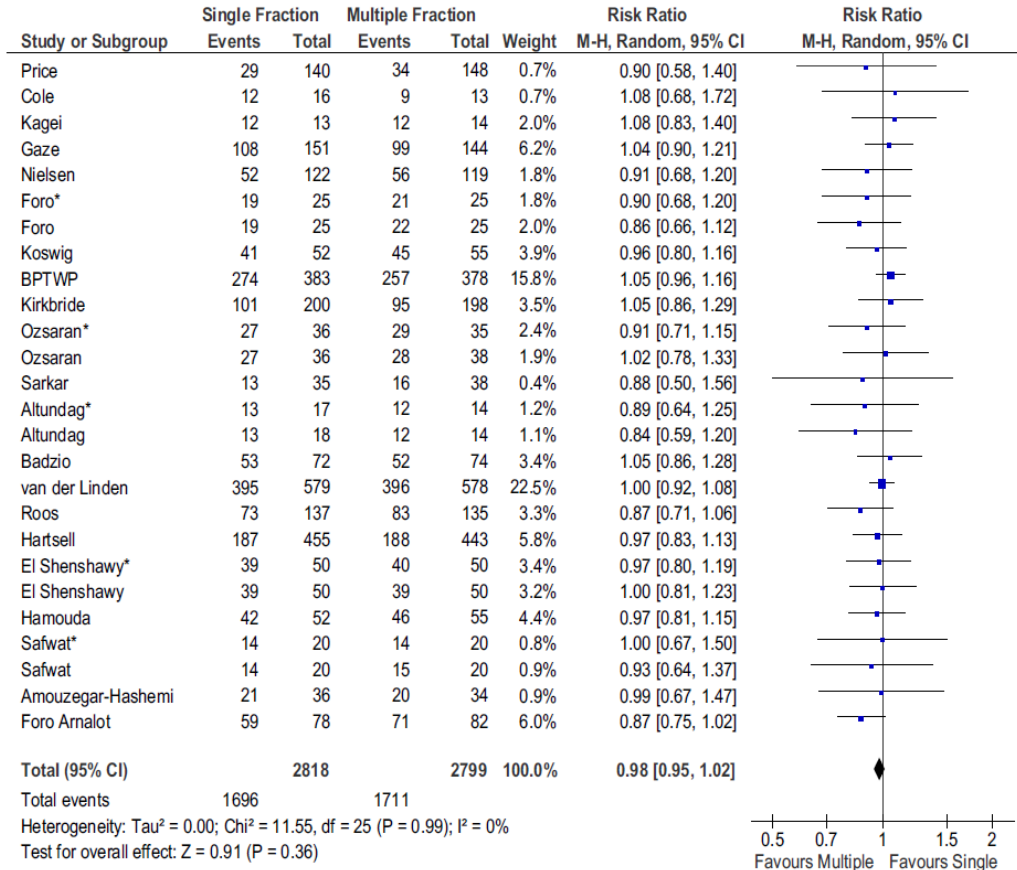
Review & metaanalysis of 25 RCTs (n=5617)

Overall pain response rate

60% vs. 61%

Complete pain response rate

23% vs. 24%



# Single versus multiple fraction RT

Furthermore:

- No difference in toxicity
- No difference in duration of response
- No increased fracture rate
- No difference in spinal cord compression
- SFRT preferred by patients
- SFRT is considerably more economical

# Choosing Wisely Canada



## **Don't recommend more than a single fraction of palliative radiation for an uncomplicated painful bone metastasis.**

Randomized trials have established that single-fraction radiation to a previously unirradiated, uncomplicated peripheral bone or vertebral metastasis provides comparable pain relief and morbidity compared to multiple-fraction regimens, while optimizing patient and caregiver convenience. Although it results in a higher incidence of retreatment at a later date (20% vs. 8 % for multi-fraction regimens), the decreased patient burden usually outweighs any considerations of long-term effectiveness for those with a limited life expectancy.

# Palliative RT acute adverse effects

Adverse effect	Frequency	Management
Fatigue	Common	Rest
Bone pain flare	~1 in 5	Analgesia consider prophylactic dex
Nausea	Location dependent (abdomen)	Supportive (PRN antiemetics)
Diarrhea	Location dependent (pelvis)	Supportive (PRN Imodium)



# Bone Pain Flare

- Occurs in ~1 in 5 patients with bone mets who get palliative RT
- “2 point” increase in pain severity
- Onset typically 24 hrs post RT
- Typically lasts 24-48 hours
- Although alarming, no long term impact
- Consider 8mg Dex prior to treating bone mets

# Palliative RT summary

- SFRT is highly effective for bone mets
- Cross sectional imaging and clinical assessment appreciated for suspected SCC
- RO will assess bone mets urgently (uncomplicated) or emergently (symptomatic cord compression)
- Bone pain flares are common, short-lived, and are managed with analgesia +/- Dex

# Summary

- RT for lung cancer continues to evolve & improve outcomes
- For lung cancer RT can be used for:
  - Early stage disease (T1-2N0) → SBRT
  - Stage III → Concurrent CRT
  - Stage IV → Bone Mets
- RT side effects are location dependent
  - Pneumonitis
  - Esophagitis
  - Bone Pain Flare

# Questions

# Fun Trivia

