Managing Lung Cancer
From the Solitary Pulmonary Nodule to Complex Cases:
A Multidisciplinary Approach

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No Disclosures

Educational Objectives

• Review work up of solitary lung nodules

• Utility of the multidisciplinary approach to lung cancer management
Case 1
• A 67 year old woman
• Undergoes annual chest X-ray for routine follow up of lymphoma
  – New 2.5cm lung nodule in the right upper medial lung field

Case 1
• History:
  – HPI:
    • Intermittent dry cough
    • No weight loss, fever, chills, fatigue, change in voice
  – PMHx:
    • Non-Hodgkins Lymphoma 2011, s/p Chemotherapy
    • Overweight, unable to loose weight
    • Hypertension
  – SHx:
    • Used to smoke 1 pack of cigarettes per day for 33 years, quit 14 years ago. (33 pack years)

Case 1
• History:
  – FHx:
    • Father died of MI @ 63 yrs
    • Mother died of breast cancer @ 72 yrs
    • Brother died in work injury @ 47 yrs
  – All: NKDA
  – Meds:
    • HCTZ 25mg
    • Multivitamins
  – ROS: non-contributory
Case 1

- Physical Exam:
  - Vitals: 37.6F, 82 bpm, 150/70 mm Hg
  - General: overweight, older woman
  - HEENT: normocephalic, no adenopathy
  - Pulm: Lungs clear to auscultation bilaterally
  - Cor: RRR, no M/R/G
  - Abd: soft, non-tender, non-distended
  - Extr: warm, well perfused, no edema

Next Step in Workup

- Interested in RUL lung nodule
  - Lab studies?
  - Imaging?
  - Pulmonary function testing?

Lung Nodule Workup: Imaging

- Characterize lesion radiographically
  - Appearance
  - Location
  - Any other findings? Nodules, enlarged lymph nodes, infiltrates, effusion
  - Appearance of remainder of lung

- Guide future steps in workup
Lung Nodule Workup: Imaging

- Chest X-ray
  - Limited resolution, may not be able to see medial structures
  - Does not provide detailed 3-D location
  - Does not provide many details about character of lesion
  - Radiologists & other providers not as adept at reading these days...

- PET-CT
  - Positron Emission Tomography-CT
  - Demonstrates areas of fluorodeoxyglucose (FDG) uptake
    - Highlights metabolically active cells
      » Brain, cardiac muscle, kidneys
      » Tumor cells
      » Infections
  - Can’t distinguish between malignant and inflammatory/infectious nodules
  - 1 cm is current limit of resolution
  - No breath hold, takes time for scan
  - Lung imaging may be obscured by breathing motion artifact
  - Useful after tissue diagnosis of cancer:
    - evaluating mediastinal nodes and elsewhere in body for metastatic disease

- Non-contrast CT scan of chest
  - Breath hold protocol to optimize resolution of lung
  - Characterize lesion radiographically
    - Appearance
    - Location
    - Any other findings:
      » Other lung nodules
      » Mediastinal & parenchymal Lymph Nodes
      » Infiltrates
      » Effusion
    - Appearance of remainder of lung
      » Bullous emphysema/bronchiectasis
Case 1: Chest X-Ray

Case 1: PET-CT

Case 1: Non-contrast Chest CT
Case 1:

- Non-contrast Chest CT demonstrates
  - 23 x 20 mm RUL nodule
  - No axillary, supraclavicular, mediastinal or hilar lymphadenopathy
  - Enlargement of R pulmonary artery

Efficient in work up of a Lung Nodule:

- Tissue diagnosis guides therapy
  - Inflammatory
    - No additional treatment, +/- surveillance
  - Infectious
    - Additional treatment
      - Antibiotics/ antifungals
      - Resection?
  - Malignancy
    - Type of cancer
      - Differentiate between metastatic to lung & primary lung Ca
      - Stage-driven treatment

Efficient in work up of a Lung Nodule:

- Obtaining tissue diagnosis:
  - Trans-thoracic needle biopsy
    - Fine-needle aspiration
    - Core needle biopsy
  - Endobronchial ultrasound-guided needle biopsy
  - Navigational bronchoscopic-guided biopsy
  - Video-Assisted Thoracic Surgery (VATS) excisional biopsy
Trans-Thoracic Needle Biopsy
– CT-guided biopsy
– Usually peripheral lesions
– Limitations/Contraindications:
  • Emphysematous lung
  • Central lesions
  • Adjacent vasculature
– Accuracy based on experience of interventionalist
– What to do with a negative biopsy?

Endobronchial Ultrasound (EBUS)
• Useful for lesions adjacent to trachea or mainstem bronchi
• Mainly used for sampling mediastinal lymph nodes
• Endoscopic Ultrasound (trans-Eosophageal) useful for lesions adjacent to distal esophagus
• Limitations/Contraindications:
  • Distal & peripheral lesions
  • Adjacent vasculature
• Accuracy based on experience of interventionalist
  • What to do with a negative biopsy?

Navigational Bronchoscopy
• Electromagnetic Navigational Bronchoscopy
• Useful for lesions in proximal to middle lung
• Limitations/Contraindications:
  • Distal lesions (mark with fiducial)
  • Adjacent vasculature
  • Medial apical/basal lesions
• Accuracy based on experience of interventionalist
• What to do with a negative biopsy?
Video-Assisted Thoracic Surgery (VATS)

- Biopsy & Treatment
  - Core needle biopsy
  - Resect nodule
  - Resect anatomic segment or lobe
- Can reach lesions throughout lungs
- Can concurrently sample LNs, pleura, pleural fluid
- Limitations/Contraindications: Pt won't tolerate surgery
- Prior to surgery:
  - Pulmonary Function Testing to ensure adequate postop predicted function
- Non-malignant biopsy usually conclusive

Case 1:

- PFTs: FEV1 1.9L (103%), DLCO/VA 111%
- TTE: no pulmonary artery HTN
- Right VATS wedge resection
  - Right upper lobe nodule
    - Visible on surface of visceral pleura
    - 2.5 x 1.7 x 1.2cm Squamous Cell Carcinoma with visceral pleural involvement
- Treatment:
  - Lobectomy
  - Mediastinal lymph node sampling
    - Complete staging
      - Hilaf nodes, mediastinal nodes (4R, 7, 8R, 9R)

Case 1:

- Postoperative course:
  - Uneventful
    - Chest tube removed POD#2
    - Discharged on POD#4 on oxycodone
- Final pathology:
  - Stage IIB (T2aN0M0) squamous cell carcinoma
    - 0/26 lymph nodes positive
- Treatment: follow up with CT imaging
  - Q6 mo x 2 yrs, then yearly (NCCN guidelines)
Non-Small Cell Lung Cancer Staging

* AJCC 7th Edition

Non-Small Cell Lung Cancer Treatment

* Spira, Ettinger, NEJM 2004
Case 2:
- 72 yo M 60 pack year former smoker
  - Enlarging right middle lobe nodule on CT
  - PET-CT performed, no distant disease
  - PFTs: FEV1 74%, DLCO/VA 63%
  - TTE: normal EF, no pulmonary artery HTN

Case 2:
- Underwent VATS right middle lobectomy & mediastinal LN biopsy
- 5 day hospital stay
- Pathology:
  - 2.9 x 2.3 x 2.0 cm Squamous Cell Carcinoma with multiple hilar nodes with tumor
  - Stage IIA (T1bN1M0)
- Referral to Med Onc for adjuvant chemotherapy

Case 3:
- 75 yo F 45 pack year smoker
  - Multiple lung nodules on screening chest CT
  - RUL nodule 1: 14x12 mm
  - RUL nodule 2: 12x11 mm
Case 3:

• 75 yo F 45 pack year smoker
  – Multiple lung nodules on screening chest CT
    • RUL nodule 1: 14x12 mm
    • RUL nodule 2: 12x11 mm
    • LLL ground glass opacity: 17 mm
    • LLL cavitory nodule: 15mm
    • Enlarged R hilar and paratracheal lymph nodes

Case 3:

• Review at Lung Cancer Multidisciplinary Conference:
  – RUL nodules suspicious for cancer
    • Recommend: CT-guided biopsy
    • If positive for cancer:
      – PET-CT, MRI brain, PFTs, TTE
  – LLL cavitory nodule indeterminate
    • Recommend: watching
  – LLL GGO
    • Recommend: watching

Case 3:

• CT-guided Needle Bx:
  – RUL nodule 1: Adenocarcinoma
  – RUL nodule 2: nondiagnostic
• PET-CT:
  – 2 RUL nodules FDG-avid (SUV 9.1 & 8.8)
  – R paratracheal LN (station 4R) FDG-avid
  – No FDG-avidity elsewhere (including other nodules)
• MRI brain: no suspicious findings
• PFTs: FEV1 1.9L (99%), DLCO/VA 79%
• TTE: normal EF, no pulmonary artery HTN
### Case 3:

- **Review at Lung Cancer Multidisciplinary Conference:**
  - RUL adenocarcinoma (T3 - multiple nodules in same lobe)

- **Plan:**
  - Sample of suspicious right hilar & paratracheal lymph nodes
  - If positive for cancer, reimage then proceed to induction chemo/radiotherapy

### Case 3:

- **EBUS:**
  - 10R lymph node with adenocarcinoma (N1)
  - Other mediastinal lymph nodes nondiagnostic

- **Mediastinoscopy:**
  - Multiple LNs with adenocarcinoma at station 4R
    - N2
  - 2R, 2L, 4L, 7 no tumor in lymph nodes (not N3)

- **Stage?:**
  - IIIA (T3 N2 M0) – assumes L disease not related
  - IV (T3 N2 M1a) – assumes L tumor nodule met from

### Case 3:

- **Repeat chest CT ~3 mo after initial CT, prior to induction chemo/radiotherapy:**
  - RUL nodules slightly larger
  - LLL GGO lesion smaller without intervention
    - Does not appear to be a cancer - shrinking
  - LLL cavitary lesion smaller without intervention
    - Does not appear to be a cancer - shrinking

- **Undergoes neoadjuvant chemo/radiotherapy:**
  - Cisplatin & etoposide
  - XRT to mediastinum 46 Gy
Case 3:

- Repeat chest CT after Chemo/Radiotherapy:
  - RUL nodules stable
  - Mediastinal LNs decreased in size
  - LLL GGO lesion smaller
  - LLL cavitory lesion smaller
- Reviewed at Lung Cancer MDC
  - Suspect L-sided disease not related to R-sided cancer
  - Proceed to surgical management of R tumor(s)
- Proceed to VATS right upper lobectomy & mediastinal LN dissection

Case 3:

- Postoperative course uneventful
  - Chest tube removed POD#3
  - Discharged home POD#5
- Pathology:
  - RUL nodule 1: 16mm adeno, <10% viable tumor
  - RUL nodule 2: 17mm adeno, pleural invasion, >10% viable tumor
  - No viable cancer in any of 10 lymph nodes
  - Molecular testing confirmed same mutation in lymph nodes from EBUS & mediastinoscopy as in RUL nodule 1, different from RUL nodule 2.
- Plan:
  - Meet with Med Onc to discuss further treatment
  - Ongoing surveillance for recurrence/ L-sided lesions

Summary

- Work up of solitary lung nodules > 1 cm:
  - Obtain high quality imaging
    - Noncontrast Chest CT
  - Review at multidisciplinary tumor board
  - If suspicious, obtain tissue
    - Trans-thoracic needle biopsy
    - Endobronchial ultrasound-guided needle biopsy
    - Navigational bronchoscopic biopsy
    - VATS excisional biopsy
  - Tissue & suspicion guides management
Summary

• Utility of the multidisciplinary approach to lung cancer management
  – Review patients with suspicious findings
  – Review patients with new diagnosis of cancer
    • Determine plan for workup of staging
    • Discuss management options
      – Patients range from simple to complex
    • Discuss options for involvement in cancer trials
  – Review patients with recurrent cancers
    • Discuss management options
    • Discuss options for involvement in cancer trials

Thank you

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