AN UNUSUAL CASE OF LUNG CANCER PRESENTING WITH CARDIAC TAMponade

Simon Correa Gaviria, MS Final year
University of Antioquia (Colombia)
Gillian Lieberman, MD
– Patient presentation
– Differential Diagnosis
– Anatomy of the Lungs
– Epidemiology of Lung Cancer
– Risk factors for Lung Cancer
– Imaging Modalities for Lung Cancer
  • Chest X Ray
  • CE Chest CT
  • MRI
  • PET/CT
– Classification of Lung Cancer
– Imaging Characteristics of Lung Cancer
  • Adenocarcinoma
  • Squamous Cell Carcinoma
  • Large Cell Carcinoma
  • Small Cell Lung Cancer (SCLC)
– Take Home Messages
– References
– Acknowledgments
PATIENT: PRESENTATION

• 36-year-old male patient

• CC
  – Dyspnea

• HPI
  – 2 days of shortness of breath, worse on the supine position.
  – It started with a sensation of abdominal distention and epigastric discomfort.
  – He reports the onset of 3-pillow orthopnea and paroxysmal nocturnal dyspnea
  – Denies palpitations, chest pain, lower extremity edema, fever or chills

• RS
  – As described above
PATIENT: PAST MEDICAL HISTORY

• PMHx
  – Irritable bowel syndrome
  – Positive PPD, received incomplete course of isoniazid for 4 months
  – 8 pack/year smoker
  – Current smoker

• NKDA

• MEDS
  – Hyoscyamine
  – Polyethylene glycol

• FHx
  – Mother died of hepatitis of unknown type
• Physical exam
  – Temp 97.6, BP 108/51, HR 112, RR 22, Sat 93% RA
  – GEN: Wd, Wn, A&Ox3, appeared mildly uncomfortable
  – HEENT: normal
  – NECK: no palpable lymph nodes
  – RESP: LCTABL, no crackles, no wheezes, no ronchi
  – CV: RRR, distant heart sounds, no murmurs, no gallops
  – ABD: mild diffuse upper abdomen tenderness
  – EXT: no edema
<table>
<thead>
<tr>
<th>Cardiac</th>
<th>Pulmonary</th>
<th>Mixed</th>
<th>Others</th>
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</thead>
<tbody>
<tr>
<td>Congestive heart failure</td>
<td>COPD</td>
<td>Pulmonary hypertension</td>
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<tr>
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<td></td>
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</tr>
</tbody>
</table>

Adapted from Morgan WC et al. Am Fam Physician. 1998 Feb 15;57(4):711-716
Findings:

1. Enlarged cardiac silhouette

2. Vertical line opacity in the LLL consistent with atelectasis

3. Obliteration of both costodiaphragmatic recesses consistent with bilateral pleural effusion

Source: MAH PACS
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Adapted from Morgan WC et al. Am fam Physician. 1998 Feb 15;57(4):711-716
Summary

✓ Pericardial effusion greater than 3.5 cm in diameter and evidence of right atrial and right ventricular collapse, consistent with cardiac tamponade

PERICARDIOCENTESIS was performed:
1 L drained + drain left in place collecting 900 cc in the following 24h

Adapted from Morgan WC et al. Am fam Physician. 1998 Feb 15;57(4):711-716
**PERICARDIAL EFFUSION WORKUP**

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pericardial fluid analysis</td>
<td>Glucose 66, total protein 5.2, fluid LDH 945, serum LDH 420</td>
</tr>
<tr>
<td>Blood cultures</td>
<td>Negative x 4</td>
</tr>
<tr>
<td>Pericardial fluid cultures</td>
<td>No growth at day 6</td>
</tr>
<tr>
<td>PCR non-TB and TB mycobacteria</td>
<td>Negative</td>
</tr>
<tr>
<td>Coxsackie B1-B6 Ab</td>
<td>Negative</td>
</tr>
<tr>
<td>Mycoplasma IgM</td>
<td>Negative</td>
</tr>
<tr>
<td>Autoimmunity panel</td>
<td>Negative</td>
</tr>
<tr>
<td>Pericardial fluid citology</td>
<td>Malignant adenocarcinoma cells consistent with spread from a lung primary</td>
</tr>
</tbody>
</table>

*Other lab tests at admission were unremarkable

** EKG showed
1. Small to moderate bibasilar pleural effusions with adjacent atelectasis

2. A hypoattenuating 2.4 x 2.1 cm lesion
THORACENTESIS WAS PERFORMED AND A SECOND CHEST CT WAS OBTAINED
1. 2.6 x 2 cm mass in the superior segment of the LLL with linear spiculated margins extending towards the posterior pleural surface.

2. Triangular and band-like areas of atelectasis in both lower lobes.

3. Multiple tiny bilateral pulmonary nodules, some of which are cavitary.
CT GUIDED BIOPSY

Non-CE Axial Chest CT-guided needle biopsy

Source: MAH PACS
LUNG BIOPSY RESULTS

☑ Adenocarcinoma consistent with lung primary

*Pleural fluid cytology was negative for malignancy
AGENDA

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LUNG CANCER
Parietal pleura

- **Mediastinal parietal pleura**: lines the lateral surface of the mediastinum
- **Costal parietal pleura**: lines the internal surface of the ribs
- **Diaphragmatic pleura**: lines the superior surface of the diaphragm
- **Cervical parietal pleura**: extends above the 1st rib to the root of the neck

Visceral pleura

Intimately attached to each lung and follows the contour of the lobes

Pleural space

Located between both pleurae. Contains pleural fluid which lubricated the surface of the pleurae
Pleural recesses
These are the locations of the pleural sac where the lung does not completely fill. There are two clinically important recesses for each lung

- **Costodiaphragmatic recess**: this is where the costal parietal pleura and the diaphragmatic pleura meet, it is located at the inferior limit of the pleural sac
- **Costomediastinal recess**: this is where the costal parietal pleura and the mediastinal pleura meet, near the midline

**CLINICAL IMPORTANCE**
These recess are the locations where abnormal fluid start accumulating, namely pleural effusion, empyema or hemothorax

Regions of the lung

- **Costal lung surface**: convex area related to the inner surface of the ribs
- **Mediastinal lung surface**: medial aspect of the lung containing the hilium related to the heart
- **Diaphragmatic lung surface**: convex area related to the dome shaped diaphragm
- **Apex lung area**: projecting to the root of the neck and crossed anteriorly by the subclavian artery
Right lung
3 lobes (superior, middle and, inferior) divided by the horizontal and oblique fissure
- **Horizontal fissure**: extending from the level of the fourth costal cartilage to the fifth intercostal space
- **Oblique fissure**: extending from the tip of T3 spinous process to the level of the sixth costochondral junction

Left lung
2 lobes (superior, and inferior) divided an oblique fissure. Instead of having a middle lobe, this lung has a space occupied by the heart, therefore it has a **cardiac notch** and an extension of the superior lobe, the lingula

General Practice Notebook, Available online at www.gpnotebook.co.uk
Radiological Anatomy of the Right Lung Lobes on Chest X Ray

Source: http://www.wikiradiography.com/photo/4384502/right+lung+anatomy
Radiological Anatomy of the Left Lung Lobes on Chest X Ray

Source: http://www.wikiradiography.com/photo/4384563/left+lung+anatomy
• 6 million new cases diagnosed worldwide in 2008, accounting for 12.7% of the world’s total cancer incidence
• Worldwide, most common cancer in men (IR 33.8 per 100,000) and fourth most frequent in women (IR 13.5 per 100,000)

EPIDEMIOLOGY: US

LUNG CANCER INCIDENCE

United States of America
Lung cancer cases annually per 100,000 people: 42.1

HDI rank: 12 of 179
GDP per capita (USD): $46,760
Health expenditure per capita (USD): $7,720
Life expectancy: 78 years

HDI: Human Development Index is a combined indicator of life expectancy, education, and income.

EPIDEMIOLOGY: US

**Incidence**
42.1 per 100,000

**Mortality Rate**

**United States of America**
Lung cancer deaths annually per 100,000 people: 30.4

**Incidence 42.1 per 100,000**

Leading New Cancer Cases and Deaths – 2014 Estimates

**Male**
- Prostate: 233,000 (27%)
- Lung & bronchus: 116,000 (14%)
- Colon & rectum: 71,830 (8%)
- Urinary bladder: 56,390 (7%)
- Melanoma of the skin: 43,890 (5%)
- Kidney & renal pelvis: 39,140 (5%)
- Non-Hodgkin lymphoma: 38,270 (4%)
- Oral cavity & pharynx: 30,220 (4%)
- Leukemia: 30,100 (4%)
- Liver & intrahepatic bile duct: 24,600 (3%)
- All sites: 855,220 (100%)

**Female**
- Breast: 232,670 (29%)
- Lung & bronchus: 108,210 (13%)
- Colon & rectum: 65,000 (8%)
- Uterine corpus: 52,630 (6%)
- Thyroid: 47,790 (6%)
- Non-Hodgkin lymphoma: 32,530 (4%)
- Melanoma of the skin: 32,210 (4%)
- Kidney & renal pelvis: 24,780 (3%)
- Pancreas: 22,890 (3%)
- Leukemia: 22,280 (3%)
- All sites: 810,320 (100%)

**Estimated Deaths**

**Male**
- Lung & bronchus: 86,930 (28%)
- Prostate: 29,480 (10%)
- Colon & rectum: 26,270 (8%)
- Uterine corpus: 20,170 (7%)
- Liver & intrahepatic bile duct: 15,870 (5%)
- Thyroid: 14,040 (5%)
- Esophagus: 12,450 (4%)
- Urinary bladder: 11,170 (4%)
- Non-Hodgkin lymphoma: 10,470 (3%)
- Kidney & renal pelvis: 8,900 (3%)
- Brain & other nervous system: 6,230 (2%)
- All sites: 310,010 (100%)

**Female**
- Lung & bronchus: 72,330 (26%)
- Breast: 40,000 (15%)
- Colon & rectum: 24,040 (9%)
- Pancreas: 19,420 (7%)
- Uterine corpus: 14,270 (5%)
- Leukemia: 10,050 (4%)
- Esophagus: 8,590 (3%)
- Non-Hodgkin lymphoma: 8,520 (3%)
- Liver & intrahepatic bile duct: 7,130 (3%)
- All sites: 275,710 (100%)

*Excludes basal and squamous cell skin cancers and in situ carcinoma except urinary bladder.*

©2014, American Cancer Society, Inc., Surveillance Research

American Cancer Society Cancer Facts and Figures 2014 Atlanta, GA: 2014
Several nations including the US have now passed the peak of the tobacco-related epidemic. Since then, incidence and mortality rates have been decreasing.

From 2006 to 2009 the lung cancer incidence rate decreased by 1.9% in men.
• Between 2006 and 2009 the lung cancer incidence rate decreased by 1.6% among women
### Estimated Number* of New Cancer Cases and Deaths by Sex, US, 2014

<table>
<thead>
<tr>
<th>Estimated New Cases</th>
<th>Estimated Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Both Sexes</strong></td>
<td><strong>Male</strong></td>
</tr>
<tr>
<td>All Sites</td>
<td>1,665,540</td>
</tr>
<tr>
<td>Oral cavity &amp; pharynx</td>
<td>42,440</td>
</tr>
<tr>
<td>Tongue</td>
<td>13,590</td>
</tr>
<tr>
<td>Mouth</td>
<td>11,920</td>
</tr>
<tr>
<td>Pharynx</td>
<td>14,410</td>
</tr>
<tr>
<td>Other oral cavity</td>
<td>2,520</td>
</tr>
<tr>
<td>Digestive system</td>
<td>289,610</td>
</tr>
<tr>
<td>Esophagus</td>
<td>18,170</td>
</tr>
<tr>
<td>Stomach</td>
<td>22,220</td>
</tr>
<tr>
<td>Small intestine</td>
<td>9,160</td>
</tr>
<tr>
<td>Colon*</td>
<td>95,830</td>
</tr>
<tr>
<td>Rectum</td>
<td>40,000</td>
</tr>
<tr>
<td>Anus, anal canal, &amp; anorectum</td>
<td>7,210</td>
</tr>
<tr>
<td>Liver &amp; intrahepatic bile duct</td>
<td>33,190</td>
</tr>
<tr>
<td>Gallbladder &amp; other biliary</td>
<td>10,650</td>
</tr>
<tr>
<td>Pancreas</td>
<td>46,420</td>
</tr>
<tr>
<td>Other digestive organs</td>
<td>5,760</td>
</tr>
<tr>
<td>Respiratory system</td>
<td>242,550</td>
</tr>
<tr>
<td>Larynx</td>
<td>12,630</td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td>224,210</td>
</tr>
<tr>
<td>Other respiratory organs</td>
<td>5,710</td>
</tr>
</tbody>
</table>

**EPIDEMIOLOGY: US**

<table>
<thead>
<tr>
<th>Probability (%) of Developing Invasive Cancers during Selected Age Intervals by Sex, US, 2008-2010*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Birth to 49</strong></td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>All sites&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Kidney &amp; renal pelvis</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Breast</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
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<tr>
<td></td>
</tr>
<tr>
<td>Leukemia</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Malignant melanoma of the skin&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Prostate</td>
</tr>
<tr>
<td>Uterine cervix</td>
</tr>
<tr>
<td>Uterine corpus</td>
</tr>
</tbody>
</table>

*For those who are cancer-free at the beginning of each age interval. **All sites excludes basal cell and squamous cell skin cancers and in situ cancers except urinary bladder. \$Statistic is for whites only.


American Cancer Society, Surveillance Research, 2014

- The probability of developing lung cancer increases with age
- The lifetime risk of developing lung cancer is 1 in 13, and 1 in 16 among men, and women, respectively

American Cancer Society Cancer Facts and Figures 2014 Atlanta, GA: 2014
### Five-year Relative Survival Rates* (%) by Stage at Diagnosis, 2003-2009

<table>
<thead>
<tr>
<th>Cancer Site</th>
<th>All Stages</th>
<th>Local</th>
<th>Regional</th>
<th>Distant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast (female)</td>
<td>89</td>
<td>99</td>
<td>84</td>
<td>24</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>65</td>
<td>90</td>
<td>70</td>
<td>13</td>
</tr>
<tr>
<td>Esophagus</td>
<td>17</td>
<td>39</td>
<td>21</td>
<td>4</td>
</tr>
<tr>
<td>Kidney</td>
<td>72</td>
<td>92</td>
<td>64</td>
<td>12</td>
</tr>
<tr>
<td>Larynx</td>
<td>61</td>
<td>76</td>
<td>43</td>
<td>35</td>
</tr>
<tr>
<td>Liver</td>
<td>16</td>
<td>29</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td>17</td>
<td>54</td>
<td>26</td>
<td>4</td>
</tr>
<tr>
<td>Melanoma of the skin</td>
<td>91</td>
<td>98</td>
<td>62</td>
<td>16</td>
</tr>
<tr>
<td>Oral cavity &amp; pharynx</td>
<td>62</td>
<td>83</td>
<td>59</td>
<td>36</td>
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<table>
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<th>Regional</th>
<th>Distant</th>
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<tr>
<td>Ovary</td>
<td>44</td>
<td>92</td>
<td>72</td>
<td>27</td>
</tr>
<tr>
<td>Pancreas</td>
<td>6</td>
<td>24</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Prostate</td>
<td>99</td>
<td>100</td>
<td>100</td>
<td>28</td>
</tr>
<tr>
<td>Stomach</td>
<td>28</td>
<td>63</td>
<td>28</td>
<td>4</td>
</tr>
<tr>
<td>Testis</td>
<td>95</td>
<td>99</td>
<td>96</td>
<td>74</td>
</tr>
<tr>
<td>Thyroid</td>
<td>98</td>
<td>100</td>
<td>97</td>
<td>55</td>
</tr>
<tr>
<td>Urinary bladder</td>
<td>78</td>
<td>70</td>
<td>33</td>
<td>5</td>
</tr>
<tr>
<td>Uterine cervix</td>
<td>68</td>
<td>91</td>
<td>57</td>
<td>16</td>
</tr>
<tr>
<td>Uterine corpus</td>
<td>82</td>
<td>95</td>
<td>68</td>
<td>17</td>
</tr>
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</table>

* Rates are adjusted for normal life expectancy and are based on cases diagnosed in the SEER 18 areas from 2003-2009, all followed through 2010. Includes renal pelvis. Includes intrahepatic bile duct. 5 Rate for in situ cases is 96%.

**Local:** an invasive malignant cancer confined entirely to the organ of origin. **Regional:** a malignant cancer that 1) has extended beyond the limits of the organ of origin directly into surrounding organs or tissues; 2) involves regional lymph nodes; or 3) has both regional extension and involvement of regional lymph nodes. **Distant:** a malignant cancer that has spread to parts of the body remote from the primary tumor either by direct extension or by discontinuous metastasis to distant organs, tissues, or via the lymphatic system to distant lymph nodes.


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- The 5-year survival rate for SMCLC is lower than that for NSCLC
- Only 15% of lung cancers are diagnosed at a localized stage, thereby increasing mortality

American Cancer Society Cancer Facts and Figures 2014 Atlanta, GA: 2014
Cigarette smoking accounts for approximately 90% of cases of lung cancer in the US

The risk of developing lung cancer in a 40 pack/year smoker is around 20 times that of someone who has never smoked.

The risk of lung cancer among ex-smokers decreases with time after smoking cessation and increases with the amount of cigarettes smoked per day.

### OTHER RISK FACTORS

- Second-hand smoke
- Asbestos
- Radon, arsenic, chromium and nickel
- Ionizing radiation
- Pulmonary fibrosis
- HIV infection

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✓ CE Chest CT
✓ MRI
✓ PET, PET/CT scan
<table>
<thead>
<tr>
<th>MODALITY</th>
<th>Chest Radiograph</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADVANTAGE</td>
<td>- Low cost&lt;br&gt;- Low radiation dose&lt;br&gt;- Widely available&lt;br&gt;- Useful in ruling out postobstructive pneumonia</td>
</tr>
<tr>
<td>DISADVANTAGE</td>
<td>- Cannot detect lymph nodes, mediastinal invasion or chest wall invasion</td>
</tr>
</tbody>
</table>

**Source:** radiopaedia.org

**PA Chest X Ray**

Stark, P. Imaging of non-small cell lung cancer. In UpToDate, Jett, JR et al (Ed), UptoDate, Waltham, MA 2014
# IMAGING MODALITIES: CE CHEST CT

<table>
<thead>
<tr>
<th>MODALITY</th>
<th>CE Chest CT</th>
</tr>
</thead>
</table>
| **ADVANTAGES** | - Relative low cost  
- Anatomic detail and differentiation of structures (tubular vs. spherical)  
- Visualization of adjacent structures (assessment of intra and extrathoracic disease)  
- Multislice CT allows even more detailed anatomy  
- USEFUL IN STAGING* |
| **DISADVANTAGES** | - Highest radiation dose (100 times more than a plain film) |

*It predicted mediastinal lymph node metastasis with a sensitivity and specificity of 51 and 86 percent, respectively, in a population with a lung cancer prevalence of 28 percent.

Stark, P. Imaging of non-small cell lung cancer. In UpToDate, Jett, JR et al (Ed), UptoDate, Waltham, MA 2014
Silvestri GA et.al. Chest. 2007;132(3 Suppl):178S
TABLE 1. TNM Descriptors From the 7th Edition Lung Cancer Staging Accepted by American Joint Committee on Cancer

Primary lesion
T0—No evidence of primary tumor
Tis—Carcinoma in situ
T1—Tumor < 3 cm surrounded by lung or visceral pleura without invasion proximal to lobar bronchus
1a—≤2 cm
1b—> 2-3 cm
T2—Tumors > 3 cm; any tumor invading the main bronchi but > 2 cm from the carina; invasion of visceral pleura; obstructive pneumonitis extending to the hila but not involving the entire lung
2a—> 3-5 cm
2b—> 5-7 cm
T3—Tumor > 7 cm. Tumor of any size that directly invades the chest wall, diaphragm, mediastinal pleura, or parietal pericardium; or involves the main bronchus within 2 cm of the carina but does not involve the carina; or results in obstructive atelectasis or pneumonitis of the entire lung. Separate nodule(s) in the same lobe
T4—Tumor invades any of the following: mediastinum, heart great vessels, trachea, esophagus, vertebral body or carina; malignant ipsilateral pleural or pericardial effusion; separate nodule(s) in a different ipsilateral lobe

N0—No regional lymph node metastases
N1—Spread to ipsilateral peribronchial or hilar nodes
N2—Spread to ipsilateral mediastinal or subcarinal nodes
N3—Spread to contralateral mediastinal or hilar nodes; scalene nodes; supraclavicular nodes

Distant disease
M0—No distant metastases
M1—Distant metastases present
M1a—Separate tumor nodule in the contralateral lung; pleural nodules; malignant pleural or pericardial effusion
M1b—All other distant metastases

TABLE 2. Staging of Lung Cancer Based on TNM Descriptors

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Carcinoma in situ</td>
</tr>
<tr>
<td>1A</td>
<td>T1N0M0</td>
</tr>
<tr>
<td>1B</td>
<td>T2aN0M0</td>
</tr>
<tr>
<td>2A</td>
<td>T2bN0M0</td>
</tr>
<tr>
<td>2B</td>
<td>T2aN1M0</td>
</tr>
<tr>
<td>3A</td>
<td>T3N0M0</td>
</tr>
<tr>
<td>3B</td>
<td>T3N1M0</td>
</tr>
<tr>
<td>4</td>
<td>Any N3</td>
</tr>
<tr>
<td></td>
<td>Any M1</td>
</tr>
</tbody>
</table>

Thinking back of our patient...

Ranevel JG. J Thorac Imaging 2012;27:315-324
<table>
<thead>
<tr>
<th>MODALITY</th>
<th>MRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADVANTAGES</td>
<td>- Helpful in assessing brain and adrenal metastases as well as chest wall, mediastinal and spinal cord invasion</td>
</tr>
<tr>
<td></td>
<td>- CE-MRI differentiates brain lesions and differentiates metastases with greater sensitivity than CE-CT</td>
</tr>
<tr>
<td></td>
<td>- Equivalent to CE-CT in T staging and detecting malignant solid pulmonary nodules (SPN)</td>
</tr>
<tr>
<td>DISADVANTAGES</td>
<td>- Highest cost</td>
</tr>
<tr>
<td></td>
<td>- Less sensitivity in detecting SPN when compared to CT</td>
</tr>
</tbody>
</table>

Source: radiopaedia.org

Non-CE Coronal Head MRI

Stark, P. Imaging of non-small cell lung cancer. In UpToDate, Jett, JR et al (Ed), UptoDate, Waltham, MA 2014
### IMAGING MODALITIES: PET/CT

<table>
<thead>
<tr>
<th>MODALITY</th>
<th>Integrated PET/CT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADVANTAGES</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Overlapping anatomic (CT) and metabolic (PET) information</td>
</tr>
<tr>
<td></td>
<td>- Distinguishes malignant lesions more accurately than CT or PET alone $^{1,2}$</td>
</tr>
<tr>
<td><strong>DISADVANTAGES</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Highest cost than CT alone</td>
</tr>
<tr>
<td></td>
<td>- High radiation</td>
</tr>
</tbody>
</table>

$^1$ Sensitivity, specificity and accuracy for malignancy were 96%, 88%, 93%, respectively, when compared to CT alone (81%, 93%, 85%)

$^2$ Comparison of CT versus PET versus PET/CT yielded accuracies of 74%, 74%, and 93%, respectively

---

Stark, P. Imaging of non-small cell lung cancer. In UpToDate, Jett, JR et al (Ed), UptoDate, Waltham, MA 2014


Source: radiopaedia.org

Axial Abdomen PET CT scan
WHO Classification for Primary Lung Cancer 2004

- Adenocarcinoma (including bronchioloalveolar carcinoma) - 38%
- Squamous cell carcinoma - 20%
- Large cell carcinoma - 5%
- Small cell carcinoma - 13%
- Other unclassified non-small cell carcinomas - 18%
- Other – 6%
– Most common histologic type (38%)
– Most prevalent histology among both smokers and no smokers
– 5 major subtypes:
  • Acinar
  • Papillary
  • Bronchioloalveolar
  • Mixed
  • Solid
– Multiple patterns
  • Solid pulmonary nodule
  • Mass-like
  • Ground glass
  • Peripheral

Invasive Adenocarcinoma (Classic Adenocarcinoma)

- Hematogenous, lymphatic local spread
- Solid mass or nodule
- Peripheral
- Margins ranging from smooth to spiculated and poorly defined

Images and text:
Bronchioloalveolar Carcinoma (BAC)

- Special subtype of adenocarcinoma
- Lepidic dissemination and no stromal, vascular or pleural invasion
- 2-6% of all LC
- Slow growth, doubling time greater than 2 years
- Better prognosis

- SPN (60-90%) with or w/o ground-glass appearance
- Pneumonia-like consolidation with bronchiogram (20%)

Images and text:
ADENOCARCINOMA

Atypical adenomatous hyperplasia (AHH)

- Premalignant lesion
- Spherical area of homogeneous ground glass attenuation measuring less than 1 cm
– Second most common histologic type (20%)
– Highly associated with smoking

SQUAMOUS CELL CARCINOMA

- Slow growth
- Spread by local invasion
- Nodal involvement occurring in a stepwise pattern
- Origin from bronquinal epithelium
- Growth through the bronchi
- Postobstructive pneumonia
- Better prognosis than other types of NSCLC

Source: lungcancer.about.com

SQUAMOUS CELL CARCINOMA

- Large central mass
- Up to 1/3 peripheral
- Ground glass opacity is very rare
- Small central tumors are difficult to assess, specially when associated with postobstructive changes
- PET/CT useful in distinguishing primary lesion from collapse

SQUAMOUS CELL CARCINOMA

- Cavitation (10-15%) with thick and irregular walls*

* Wall thickness greater than 16 mm is highly suggestive of malignancy

– Uncommon histologic type (5%)
– Poorly differentiated
– Strongly associated with smoking
– Neuroendocrine variant 3 to 4 times more common in men
– Highly aggressive
– Early metastases to mediastinum and CNS
– 5-yr survival rate of 12.1%
LARGE CELL CARCINOMA

- Large, peripheral tumor
- Most commonly found in the upper lobes
- Well defined tumor-lung interface
- Calcification is uncommon

– Uncommon histologic type (13 %)
– Neuroendocrine tumour
– Almost exclusive of smokers
– Rapid doubling time
– Early development of metastatic disease
– Early mediastinum and hiliar invasion
– SVC syndrome in 11-12%
– 5-yr survival rate of 6%

SMALL CELL CARCINOMA

- Large central multifocal masses
- Early hiliar and mediastinal involvement
AGENDA

✓ Patient presentation
✓ Differential Diagnosis
✓ Anatomy of the Lungs
✓ Epidemiology of Lung Cancer
✓ Risk factors for Lung Cancer
✓ Imaging Modalities for Lung Cancer
  ✓ Chest x Ray
  ✓ CE Chest CT
  ✓ MRI
  ✓ PET/CT
✓ Classification of Lung Cancer
✓ Imaging Characteristics of Lung Cancer
  ✓ Adenocarcinoma
  ✓ Squamous Cell Carcinoma
  ✓ Large Cell Carcinoma
  ✓ Small Cell Lung Cancer (SCLC)

– Take Home Messages
– References
– Acknowledgments
1. Lung cancer is still a prevalent disease
2. Radiology is fundamental in the assessment, diagnosis, and care decisions in lung cancer
3. There is no pathognomonic signs for any type of lung cancer, however certain types of lung cancer follow usual radiologic patterns
• DIAGNOSIS
• STAGING
• PROCEDURE/BIOPSY
• PROGNOSIS
• TREATMENT DECISIONS
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• Daniel Carr, MD
• Tina Islam, MD PhD
• Gillian Lieberman, MD
GRACIAS