Sleep Apnea / Screening for Lung Cancer

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Goals and Objectives:
- Sleep Disordered Breathing (aka Sleep Apnea)
  - Obstructive Sleep Apnea vs Central Sleep Apnea
  - Presenting Symptoms and Signs
  - Consequences
  - Treatment
- Screening for Lung Cancer
  - Which patients?
  - Which method?

Sleep Disordered Breathing
- Obstructive Sleep Apnea
  - Due to obstruction of the upper airway
- Central Sleep Apnea
  - Failure of the brain to initiate respiration
- Obesity-Hypoventilation Syndrome
  - Almost all also have OSA
  - Hypo-ventilate even when awake
Obstructive Sleep Apnea (OSA)

- Upper Airway Obstruction with preserved chest/abdominal effort

Airflow

Thoracic Effort

Obstructive Apnea

EEG

Airflow

Effort Rib cage

Effort Abdomen

Effort Esophageal pressure (cm of water)

Oxygen saturation (%)
Sleep Disordered Breathing
- Obstructive Sleep Apnea
  - Due to obstruction of the upper airway
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  - Almost all also have OSA
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Obesity Hypoventilation Syndrome (OHVS)

Great Overlap
- Often mixed Obstructive and Central
- Most OHVS also have OSA

Diagnosis
- Polysomnography (i.e. a “Sleep Study”)
Apnea-Hypopnea Index (AHI)

- The combined number of 10-second episodes per hour of:
  - Apnea: Complete cessation of airflow
  - Hypopnea: Partial reduction in airflow

- Severity:
  - Normal: <5
  - Mild: 5-15
  - Moderate: 16-30
  - Severe: > 30

Risk Factors

- Obstructive Sleep Apnea:
  - Obesity
  - Neck Circumference (>17 in)
  - Hypertension
  - Male Gender
  - Increasing Age
  - Smoking
  - Retrognathia

- Central Sleep Apnea
  - CHF and CNS Disease

OSA: Epidemiology

- 5% of adults overall
- US White Males with BMI 25-28
  - 1 in 5: AHI > 5
  - 1 in 15: AHI > 15
- 1% change in body weight
  - results in 3% change in AHI
- 10% increase in weight
  - results in 6X risk of progressing from mild to moderate OSA
Consequences:
- Fragmented Sleep
- Daytime Hypersomnolence
- Intellectual Impairment
- Repeated Episodes of Hypoxia
  - Pulmonary Hypertension
  - Polycythemia
- Other:
  - HTN, Stroke, Arrhythmia, Glucose Intolerance, Immune System Activation ...

Epworth Sleepiness Scale

<table>
<thead>
<tr>
<th>Likelihood to fall asleep in the following situation</th>
<th>1-6: Normal</th>
<th>7-8: Average</th>
<th>9 or more: Seek medical advice immediately!</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sitting and reading</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2. Watching TV</td>
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<td></td>
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<tr>
<td>3. Sitting, reading in a public place (e.g., waiting room, a theater or a meeting)</td>
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<tr>
<td>4. As a passenger in a car for an hour without a break</td>
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<td></td>
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<tr>
<td>5. Lying down to rest in the afternoon when circumstances permit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Sitting and talking to someone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Sitting quietly after lunch without alcohol</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>8. In a car, while stopped for a few minutes in traffic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0. Would never doze off</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. slight chance of dozing off</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. moderate chance of dozing off</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. high chance of dozing off</td>
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Even Mild OSA Increases Risk of HTN

[Graph showing the relationship between Apnea-Hypopnea Index and odds ratio for HTN]
Treatment of OSA may improve CHF

Why CV Effects?

Treatment
- General:
  - Weight Loss
  - Avoid Sedatives
  - Treat Nasal Congestion
  - Avoid Supine Sleeping Position
- Nasal CPAP / BiPAP
  - Continuous vs BiLevel Positive Airway Pressure
- ENT Eval
  - Oral Devices
  - UPPP
  - Tracheostomy
Lung Cancer Screening

- Leading cause of cancer death for men and women
  - More than colon, breast, and prostate combined
  - Overall five-year survival remains 14%
    - Only liver and pancreas are worse
      - brain, leukemia, multiple myeloma, melanoma, esophagus are all better
  - 15 years of life lost per lung cancer death

Screening Rationale: Catch Cancer Early

- 5-year Survival
  - Stage I is almost never symptomatic
  - > 95% of patients presenting with symptoms will die of their disease

But screening didn’t

- Screening identified:
  - More cancers
  - More early stage cancers
  - More resectable cancers
- And screening resulted in a better 5-yr survival
- BUT NO reduction in Lung Cancer Mortality
  - Screened patients had a higher likelihood of being diagnosed and living longer from the time of diagnosis
  - BUT just as many screened patients ultimately died of cancer.

Screening has to work?

- Four nonrandomized uncontrolled studies of CXR’s
  - Philadelphia Pulmonary Neoplasm Research Project
  - VA Trial
  - Tokyo Metropolitan Government Study
  - South London Lung Cancer Study
- Two nonrandomized but controlled studies of CXR’s
  - North London Cancer Study
  - Erfurt County Study
- Four randomized trials of CXR’s and Sputum Cytology
  - Johns Hopkins Lung Project
  - Memorial Sloan-Kettering Lung Project
  - Mayo Lung Project (MLP)
  - Czechoslovakian Study


1950's
1970's

Asymptomatic
More curable

Symptomatic
Less curable

Graph of Tumor Growth vs. Number of Metastases

- 1/3 growth
- 2/3 growth
- 3/3 growth

USPSTF Recommendations

- AGAINST screening for lung cancer (up until 1999)

Early Lung Cancer Action Program (ELCAP)

- 1000 patients
  - Entry Criteria
    - Age > 60
    - > 10 pack year cigarette use
  - Actual Mean Patient
    - Age = 67
    - 45 pack years
  - Low Dose CT (LDCT) and CXR


Early Lung Cancer Action Program (ELCAP)

- Results:
  - 233/1000 patients at least 1 Non-Calcified Nodule (NCN) on LDCT
    - i.e. “Positive” Scan
  - 27/233 were Malignant
    - CXR missed 20 of these
  - 26/27 were Resectable
    - Theoretically curable due to early detection

### Stage of the 27 Malignant Nodules

- 85% Stage I
- 83% missed by CXR
- Overall, 96% resectable

- Proves CT’s can find small cancers
- BUT no control group
- AND what about all the “False Positives”
- 233 “positive” scans but only 27 cancers
- Therefore, 206 “False Positives”


### USPSTF Recommendations

- INDETERMINATE support for LDCT to screen for lung cancer
  
  *up until 2014*

### Other ELCAP Findings: Size Matters

<table>
<thead>
<tr>
<th>Size of Largest NCN in mm</th>
<th>Chance of Malignancy vs Size of Largest NCN</th>
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<tbody>
<tr>
<td>2-5</td>
<td>1%</td>
</tr>
<tr>
<td>6-10</td>
<td>24%</td>
</tr>
<tr>
<td>11-20</td>
<td>33%</td>
</tr>
<tr>
<td>&gt;20</td>
<td>80%</td>
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Fleischner Guidelines

<table>
<thead>
<tr>
<th>Size</th>
<th>Low Risk</th>
<th>High Risk</th>
</tr>
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<tbody>
<tr>
<td>&lt; 4 mm</td>
<td>No further evaluation</td>
<td>1 flu CT (in 1 year)</td>
</tr>
<tr>
<td>4-6 mm</td>
<td>1 flu CT (in 1 year)</td>
<td>2 flu CT’s (6-12 and 18-24 mos)</td>
</tr>
<tr>
<td>6-8 mm</td>
<td>2 flu CT’s (6-12 and 18-24 mos)</td>
<td>3 flu CT’s (3-6, 9-12, and 24 mos)</td>
</tr>
<tr>
<td>&gt; 8 mm</td>
<td>PET Scan (then biopsy/section VERSUS flu CT in 3 mos/9 mos/24 mos)</td>
<td></td>
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- Compared LDCT with CXR’s annually for 3 years
- 53,454 “High Risk” individuals
  - Age 55-74
  - 30 Pack Year Smoking History
  - Could not have stopped smoking more than 15 years ago
  - Study stopped early after a median f/u of 6.5 years

NLST Results

<table>
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<tr>
<th>Lung Cancer Cases Identified*</th>
<th>LDCT</th>
<th>CXR</th>
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<tr>
<td>645</td>
<td>572</td>
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<table>
<thead>
<tr>
<th>Lung Cancer Deaths*</th>
<th>LDCT</th>
<th>CXR</th>
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<tr>
<td>247</td>
<td>309</td>
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</table>

*per 100,000 person years

Reduced lung cancer death rate:
- 20% Relative Risk Reduction (CI 3.8-26.7)
- Absolute Risk Reduction of death from lung cancer of 0.313%
- 320 scans to prevent 1 lung cancer death
NSLT Limitations

- LDCT compared to CXR?
- "Healthy Volunteer" Effect
  - > 30% had college or higher level education
- Expertise of Radiologists and Surgeons in the study compared to community
- Costs
- ? Impact on Smoking Cessation rates
  - Could help / Could hinder

USPSTF - December 2013:

- The USPSTF recommends annual screening for lung cancer with low-dose computed tomography in adults ages 55 to 80 years who have a 30 pack-year smoking history and currently smoke or have quit within the past 15 years. Screening should be discontinued once a person has not smoked for 15 years or develops a health problem that substantially limits life expectancy or the ability or willingness to have curative lung surgery.
  - Grade: B [Recommendation]

Canadian Task Force on Preventive Health Care:

- For adults aged 55-74 years with at least a 30 pack-year smoking history who currently smoke or quit less than 15 years ago, we recommend annual screening with LDCT up to three consecutive times. Screening should ONLY be carried out in health care settings with expertise in early diagnosis and treatment of lung cancer.