Lung Cancer
Disclosures:

None
COPD is the third leading cause of death in the US.
The primary cause of COPD is tobacco smoke.

November is COPD Awareness Month.

#ThoracicFact
Cancer is one of the most common diseases in the developed world:
- 1 in 4 deaths are due to cancer
- 1 in 17 deaths are due to lung cancer
- Lung cancer is the most common cancer in men
- Breast cancer is the most common cancer in women
- There are over 100 different forms of cancer

1 in 4 deaths are due to cancer
1 in 17 deaths are due to lung cancer
Lung cancer is the most common cancer in men
Breast cancer is the most common cancer in women
There are over 100 different forms of cancer
NSCLC 5 Year Overall Survival Percentage NCDB vs SOMC

Cases diagnosed from 2003-2006

Overall

17
6.5
16
5.5
15
4.5
14
3.5
13
12.5

NCDB
SOMC
SOMC Lung Cancer by Stage % Living Today
Cases Diagnosed from 2010-2013

Percent Survival

<table>
<thead>
<tr>
<th>Stage</th>
<th>Percent Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I</td>
<td>73.9</td>
</tr>
<tr>
<td>Stage II</td>
<td>65.2</td>
</tr>
<tr>
<td>Stage III</td>
<td>43.1</td>
</tr>
<tr>
<td>Stage IV</td>
<td>26.9</td>
</tr>
</tbody>
</table>
SOMC Lung Cancer by Stage % Living Today
Cases Diagnosed from 2010-2013

Percent Survival

Stage 1A: 76.4%
Stage 1B: 66.6%
Stage 2A: 76.6%
Stage 2B: 43.7%
Stage 3A: 41.2%
Stage 3B: 46.8%
Stage 4: 26.9%
**Omitted stage 0, occult, and unknown**
<table>
<thead>
<tr>
<th>Stage</th>
<th>Number of Cases</th>
<th>Cases Alive</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>68-26 had surgery-of the 26, 23 of them are in the alive cases</td>
<td>52</td>
</tr>
<tr>
<td>1B</td>
<td>24-12 had surgery-of the 12, 12 are alive!</td>
<td>16</td>
</tr>
<tr>
<td>2A</td>
<td>30-4 had surgery and all of the 4 are in the alive cases</td>
<td>23</td>
</tr>
<tr>
<td>2B</td>
<td>16-6 had surgery and 4 are in the alive cases</td>
<td>7</td>
</tr>
<tr>
<td>3A</td>
<td>63-7 had surgery-of the 7 four of them are in the alive cases</td>
<td>26</td>
</tr>
<tr>
<td>3B</td>
<td>32-none had surgery</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>104</td>
<td>28</td>
</tr>
</tbody>
</table>
SOMC Lung Cancer by Stage % Living Today

Cases Diagnosed from 2010-2013

<table>
<thead>
<tr>
<th>Stage</th>
<th>Percent Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>76.4</td>
</tr>
<tr>
<td>1B</td>
<td>66.6</td>
</tr>
<tr>
<td>2A</td>
<td>76.6</td>
</tr>
<tr>
<td>2B</td>
<td>43.7</td>
</tr>
<tr>
<td>3A</td>
<td>41.2</td>
</tr>
<tr>
<td>3B</td>
<td>46.8</td>
</tr>
<tr>
<td>4</td>
<td>26.9</td>
</tr>
</tbody>
</table>
Cases Reported % of NSCLC vs SCC

SOMC
- Non-Small Cell: 21%
- Small Cell: 79%

NCDB
- Non-Small Cell: 15%
- Small Cell: 85%
The Statistics

Top 10 Cancer Sites: 2009, Male and Female, United States—All Races

- Prostate: 137.7
- Female Breast: 123.1
- Lung and Bronchus: 64.3
- Colon and Rectum: 42.5
- Corpus and Uterus, NOS: 25.1
- Urinary Bladder: 20.5
- Melanomas of the Skin: 19.4
- Non-Hodgkin Lymphoma: 18.9
- Kidney and Renal Pelvis: 15.7
- Thyroid: 13.2

Rates per 100,000‡
Lung Cancer is the leading cancer diagnosis @ SOMC
• Lung cancer is the leading cause of CANCER Death
• Despite improvement in survival in other malignancies, lung cancer survival has remained @ 15% over decades
• 221 K will be diagnosed and 150 k will die from lung cancer in the US/year
• Lung cancer is the leading cancer worldwide in incidence and mortality
Mortality data

Overall survival by TNM grouping, non-small cell lung cancer

Trend and likely due to late diagnosis

<table>
<thead>
<tr>
<th>Year</th>
<th>Lung Cancer Dx</th>
<th>Lung Cancer Dx w/Surgery (does not include Bronchs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>126</td>
<td>24</td>
</tr>
<tr>
<td>2010</td>
<td>95</td>
<td>19</td>
</tr>
<tr>
<td>*2011</td>
<td>71</td>
<td>15</td>
</tr>
</tbody>
</table>
FY 2011-85, 35 died.
FY 2012-75, 21 died
FY 2013-93, 28 died

Suitable for surgery were roughly 17 in 2013
15 of 85 for FY 2011 went to surgery

- 18 Stage 1A
- 2 Stage 1B
- 11 Stage 2B
- 17 Stage 3A
- 4 Stage 3B
- 3 Stage 3 no specification A or B
- 24 Stage 4
17 of 75 in FY 2012 went to surgery
- 10 Stage 1A
- 9 Stage 1B
- 4 Stage 2A
- 14 Stage 3A
- 9 Stage 3B
- 1 Stage 3 no specification A or B
- 25 Stage 4
16 of 93 in FY 2013 went to surgery
- 15 Stage 1A
- 3 Stage 1B
- 5 Stage 2A
- 20 Stage 3A
- 7 Stage 3B
- 1 Stage 3 no specification A or B
- 35 Stage 4

Lung Cancer is a serious Health problem
The Screening Concept

Initial trials showed no benefit for cxr and sputum cytology
A series of studies followed. Some were suggestive that Low Dose CT is a reasonable tool, some did not. Specially from the Italian group

The studies differed in their detection methods and periods of observation.
The ideal screening Tool:

- Sensitivity
- Specificity
- Low Cost
- Objective
- Easy lexicomp
A detailed description of the NLST design, methods, and initial results has been previously reported; the present study used extended follow-up data through December 31, 2009. From August 2002 through April 2004, 53,452 individuals at high risk for lung cancer, with at least a 30 pack-year history of cigarette smoking (former smokers had quit within the past 15 years), between the ages of 55 and 74 years were enrolled at 33 US medical centers into a prospective screening trial. The study protocol was approved by the institutional review board at each of the 33 screening centers, and written informed consent was obtained from each participant before randomization. All participants were randomly assigned to receive either 3 annual LDCT studies (26,722 participants) or 3 annual single-view posterior-anterior CXRs (26,730 participants) and then observed for up to an additional 5 years. The primary trial objective was to determine the effect of LDCT screening vs CXR screening on lung cancer mortality.
There were 247 deaths from lung cancer per 100,000 person-years in the low-dose CT group and 309 deaths per 100,000 person-years in the radiography group, representing a relative reduction in mortality from lung cancer with low-dose CT screening of 20.0% (95% CI, 6.8 to 26.7; P=0.004). The rate of death from any cause was reduced in the low-dose CT group, as compared with the radiography group, by 6.7% (95% CI, 1.2 to 13.6; P=0.02).
Screening for lung cancer has the potential to reduce mortality, but in addition to detecting aggressive tumors, screening will also detect indolent tumors that otherwise may not cause clinical symptoms. These overdiagnosis cases represent an important potential harm of screening because they incur additional cost, anxiety, and morbidity associated with cancer treatment.
Differential side total recommendations was different motives


http://www.acr.org/~media/ACR/Documents/PDF/Advocacy/Fed%20Relations/LCS%20Stakeholder%20Letter%202009%202014_FINAL.PDF
Screening for Lung Cancer: U.S. Preventive Services Task Force Recommendation Statement

Virginia A. Moyer, MD, MPH, on behalf of the U.S. Preventive Services Task Force*[

Article and Author Information

http://annals.org/article.aspx?articleid=1809422#
Recommendation: The USPSTF recommends annual screening for lung cancer with low-dose computed tomography in adults aged 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. (B recommendation)
Overdiagnosis in Low-Dose Computed Tomography Screening for Lung Cancer

FREE ONLINE FIRST

Edward F. Patz Jr, MD1,2; Paul Pinsky, PhD3; Constantine Gatsonis, PhD4,5; JoRean D. Sicks, MS4; Barnett S. Kramer, MD, MPH3; Martin C. Tammemägi, PhD6; Caroline Chiles, MD7; William C. Black, MD8,9; Denise R. Aberle, MD10; for the NLST Overdiagnosis Manuscript Writing Team

[+]

Author Affiliations


Text Size: A A A
Results  During follow-up, 1089 lung cancers were reported in the LDCT arm and 969 in the CXR arm of the NLST. The probability is 18.5% (95% CI, 5.4%-30.6%) that any lung cancer detected by screening with LDCT was an overdiagnosis, 22.5% (95% CI, 9.7%-34.3%) that a non–small cell lung cancer detected by LDCT was an overdiagnosis, and 78.9% (95% CI, 62.2%-93.5%) that a bronchioalveolar lung cancer detected by LDCT was an overdiagnosis. The number of cases of overdiagnosis found among the 320 participants who would need to be screened in the NLST to prevent 1 death from lung cancer was 1.38.
Conclusions and Relevance  More than 18% of all lung cancers detected by LDCT in the NLST seem to be indolent, and overdiagnosis should be considered when describing the risks of LDCT screening for lung cancer.
Screening for Lung Cancer: Moving Into a New Era

Frank C. Detterbeck, MD; and Michael Unger, MD

Published online 31 December 2013
doi:10.7326/M13-2904
The editors called for:

- Programs registry
- Language interpretation (algorithms)
- This is why the recent societal recommendations aimed toward a center of excellence

http://www.acr.org/Quality-Safety/Lung-Cancer-Screening-Center
Multiple stake holders have comments

- ARA
- ACCP/ACP
- NCI
- ATS
The End of the beginning?
The ACCP guidelines

http://www.chestnet.org/Guidelines-and-Resources
How do we interpret the SPN finding

- Who should do it, radiologist? Will classify.
- How do we do it?
- Lung rads: From 0-4.
- 0. Incomplete evaluation.
- 1. Negative
- 2. Benign behavior. One-year follow-up
- 3. Probably benign six-month follow-up
- 4. Suspicious tissue versus 3 months. Evaluation versus PET scan. Depending on the degree of suspicion
- Significant other finding.
- C prior history of CA

Nodules

Definition: SPN, coin lesion, multiple lesions, incidentaloma

- Size: less than 3cm
- Mass: greater than 3cm
The pulmonologist strategy

**RISK FACTORS FOR LUNG CANCER IN PATIENTS WITH SOLITARY PULMONARY NODULES**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low</th>
<th>Intermediate</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nodule size, diameter in mm</td>
<td>&lt;8</td>
<td>8-20</td>
<td>&gt;20</td>
</tr>
<tr>
<td>Age, yr</td>
<td>&lt;45</td>
<td>45-60</td>
<td>&gt;60</td>
</tr>
<tr>
<td>Prior cancer history</td>
<td>No prior cancer</td>
<td>Prior cancer history</td>
<td></td>
</tr>
<tr>
<td>Tobacco use</td>
<td>Never smoked</td>
<td>Current smoker &lt;1 pack per day</td>
<td>Current smoker ≥ 1 pack per day</td>
</tr>
<tr>
<td>Smoking cessation</td>
<td>Quit ≥ 7 yr ago</td>
<td>Quit &lt;7 yr ago</td>
<td>Never quit</td>
</tr>
<tr>
<td>Chronic obstructive lung disease</td>
<td>No COPD</td>
<td>COPD</td>
<td></td>
</tr>
<tr>
<td>Asbestos exposure</td>
<td>No exposure</td>
<td>Exposed</td>
<td></td>
</tr>
</tbody>
</table>
Nodule's Size vs. Probability of Cancer

- < 5mm: less than 1% chance to be cancerous
- 5 - 10mm: 28% chance to be cancerous
- 11 - 20mm: 33-64% chance to be cancerous
- > 20mm: 64-84%
Characteristics of Nodules vs. Cancer

- Solid, semi-solid, and ground-glass
- Irregular, lobulated, or spiculated
- Nodules, pure ground-glass or semi-solid, are more likely malignant than solid
Swenson and coworkers (1997) developed a model to assign the probability of cancer that involves the same variables previously mentioned. http://www.chestx-ray.com/index.php/calculators/spn-calculator
Density of Benign-Appearing Nodules

Figure 2.

(A) Diffuse calcified granuloma. (B) Granuloma with central calcification. (C) Hamartoma with popcorn pattern of calcifications. (D) Hamartoma with fat density areas (~31.25 HU). (E) Laminated calcification pattern indicative of benign disease.
Ground-Glass Nodules

- Ground-glass appearing nodules should not be resected
  - They are slow growing and are associated with favorable prognosis
  - If accelerated growth, or develop a solid component, then they're likely malignant
Further testing: PET

- PET is less sensitive for those <10mm, and false negatives have been reported in adenocarcinoma, carcinoid tumors
- False positive PET scans have been reported in sarcoid and RA or infections

- CT-FNA with pneumothorax incidence varies 15-40%, requiring chest tube for management
- Conventional bronchoscopy useful for central lesions
- EBUS yield 73%
- Navigational bronchoscopy improved the diagnostic yield
- Surgical VATS
<8mm and stable for 2 years: no further follow up, **THIS NO LONGER IS TRUE!!**

>8mm: PET scan, then location of nodule will dictate the method of tissue sampling. Consider the following:

- Patient's underlying condition
- Ability to withstand intervention and therapy
- Pulmonary function, including MVV
- Surgery for ground-glass, semi-solid, or method of tissue sampling
- Solid: watchful observation vs. tissue, depending on PET
Important history elements

- Personal history of cancer.
- Family history of cancer of the lung.
- Previous history of radiation treatments.
- Employment history and exposure to hazardous material.
- HIV.
- Previous scarring.
diagnosis what is the best strategy for the individual patient

Debaters include Med Onc, Rad ONC, Thoracic surgeon, and pulmonologist
Advances in technology

- Diagnostic peripheral bronchoscopy
- Advances in bronchoscopy/tissue handling
- EBUS
- EUS
Advances in medical treatment

- Predictive of treatment efficacy & drug toxicity
  - Bevacizumab: increased toxicity in pts w/squamous histology
  - Pemetrexed: improved outcomes in nonsquamous NSCLC
  - EGFR TKIs
- Prognostic
Targeted therapy
- EGFR 17 percent of adeno carcinoma
- Alk 7 percent
- BRAF 2 percent
- Her2 2 percent
- Essentially 52 % had identifiable mutations

The Pathology is the key for precision medicine
Advances in Radiation
Advances in surgical therapy

- VATS
- ROBOTS
- Segmentectomy
- wedge
What do we expect

- Screening will be limited to the highest risk pts to make financial sense
- Biomarkers will be added
- We will see further molecular targeted therapy
- The cancer genome atlas shows that tumor mutations are shared by many organ tumors by the NIH
Cost-Effectiveness of CT Screening in the National Lung Screening Trial
