Incidental Findings on Low-Dose CT for Lung Cancer Screening

Kim L. Sandler, MD
Co-Director, Vanderbilt Lung Screening Program

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Disclosures

• None
Objectives

• Identify patients who are eligible to be screened for lung cancer with LDCT.
• Understand the basic reporting system for findings on lung screening CT.
• Be able to identify clinically significant incidental findings on LDCT.
• Be able to provide recommendations for follow up of incidental findings discovered on lung screening exams.
Meet Benjamin

- 63 year old Nashville native, smoked a pack a day for 35 years
- Quit smoking in 2015
- Married, three children, expecting his first grandchild this fall
- Enjoys bike riding and travelling with his family
May 15, 2017

LungRADS 4A

Recommendation made for close surveillance with 3 month follow-up
August 23, 2017

- Benjamin presented for follow-up exam
- RUL pulmonary nodule had grown from 9 x 11 mm to 10 x 13 mm
- Underwent bronchoscopy diagnostic of adenocarcinoma
- PET-CT negative for metastatic disease
- Successfully treated with minimally invasive surgical resection
CT Lung Cancer Screening: Findings From The NELSON Trial

- NELSON is the second largest randomized controlled trial to demonstrate a reduction in lung cancer mortality with CT screening of people at high risk. The NLST was the first.
- About 50% of the cancers diagnosed in the screening arm were early stage, and 65% to 70% were stages IA to II; about 70% of cancers in the control arm were stage III/IV at diagnosis.
- Overall, CT scanning decreased mortality by 26% in high-risk men and up to 61% in high-risk women over a 10-year period.
Lung cancer screening eligibility from CMS

Participants
Age: 55 – 77
30 Pack-years smoking and less than 15 years since quitting
No signs or symptoms of lung cancer

Clinician
Shared Decision Making Visit – Benefits/Harms of Screening,
Follow-up diagnostics tests, over-diagnosis, FP rate, radiation exposure
Counseling on adherence to the screening program and smoking cessation

Radiologist
Board Certified, Training in diagnostic radiology and radiation safety
Supervision and interpretation of 300 chest CTs in past 3 years
CME to ACR standard

Radiology Imaging Facility
LDCT with CTDIvol < 3.0mGy for standard patients
Utilizes a standardized lung nodule classification and reporting system
Collects and submits data to a CMS-approved registry
Lung Cancer Deaths in Tennessee

Deaths from Lung Cancer by State

Rates of dying from lung cancer also vary from state to state.

Lung and Bronchus Cancer
Death Rates* by State, 2013†

Less than 2% of eligible Tennesseans are enrolled in a lung screening program

*Rates are per 100,000 and are age-adjusted to the 2000 U.S. standard population.

Vanderbilt Lung Screening Program

- Participated in the National Lung Screening Trial
- Enrollment as of February 1, 2019
  - Over 1350 patients enrolled
  - > 2200 screening examinations performed
  - > 100 referrals made to the Vanderbilt Lung Nodule Clinic
  - 45 cancers diagnosed
  - 9% of patients with significant incidental findings
<table>
<thead>
<tr>
<th>Category Descriptor</th>
<th>Category Descriptor</th>
<th>Primary Category</th>
<th>Expected Distribution</th>
<th>Probability of Malignancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incomplete</td>
<td>-</td>
<td>0</td>
<td>90%</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td>Negative</td>
<td>No nodules &amp; definitely benign nODULES</td>
<td>1</td>
<td>90%</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td>Benign Appearance or Behavior</td>
<td>Nodules with a very low likelihood of becoming a clinically active cancer due to size or lack of growth</td>
<td>2</td>
<td>90%</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td>Benign Appearance or Behavior</td>
<td>Probably benign finding(s) - short term follow up suggested; includes nodules with a low likelihood of becoming a clinically active cancer</td>
<td>3</td>
<td>90%</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td>Suspicious</td>
<td>Findings for which additional diagnostic testing and/or tissue sampling is recommended</td>
<td>4A</td>
<td>90%</td>
<td>&lt; 1%</td>
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<td>4B</td>
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<td>&lt; 1%</td>
</tr>
</tbody>
</table>
Lung Screening CT
Diagnostic PET/CT
Diagnostic PET/CT
Clinically significant findings

• How do you define clinically significant findings on LDCT for lung screening?
  – VLSP defines clinically significant incidental findings as those that require additional imaging or laboratory testing for diagnosis or follow up
  – We exclude coronary artery disease (CAD) and emphysema as these are not unexpected findings in our patient population
  – CAD is reported with an estimated Agatston score
## Clinically significant findings

<table>
<thead>
<tr>
<th>Category descriptor</th>
<th>Findings</th>
<th>Management</th>
<th>Probability of malignancy</th>
<th>Estimated population prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinically significant or potentially clinically significant findings (non lung cancer)</td>
<td>Modifier- may add on to any 0-4 coding</td>
<td>As appropriate to the specific finding</td>
<td>N/A</td>
<td>10%</td>
</tr>
</tbody>
</table>
Clinically significant findings
Clinically significant findings

RT KIDNEY

Department of Radiology
and Radiological Sciences
Clinically significant findings
Renal cell carcinoma
Clinically significant findings

Aneurysmal dilatation of ascending and descending thoracic aorta – recommended CTA
Thoracic aortic aneurysms
Thoracic aortic aneurysm management

Thoracic aortic aneurysm detected

Aortic root or ascending aorta 4.0–5.0 cm
- Obtain dedicated aortic imaging at initial visit and at 6 months
- Optimize medical management with beta-blocker or angiotensin II receptor blocker
  - Restrict activity
  - Stable or slow rate of growth
    - Annual imaging and follow-up
  - Rapid growth (> 0.5 cm/year) or other surgical indication
    - Refer to surgeon

Aortic root or ascending aorta > 5.0 cm
- Or aortic cross-sectional area-to-height ratio > 10 cm²/m in a patient with Marfan syndrome
- Or aortic diameter > 5.5 cm in a patient with bicuspid aortic valve
  - Optimize medical management
  - Restrict activity
  - Refer to surgeon

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^ It is reasonable to consider earlier surgical referral once the aortic diameter is greater than 4.5 cm in a patient with Marfan syndrome or bicuspid aortic valve.

^ Surgery is reasonable in a patient with a bicuspid aortic valve with a diameter 5.0–5.5 cm if additional risk factors are present (rapid growth or family history of aortic dissection), or if the patient is at low surgical risk and the surgery is performed by an experienced surgical team, or with a diameter > 4.5 cm if there is an indication for aortic valve replacement.

^ Frequency of imaging surveillance may be increased if the aortic diameter is > 4.5 cm in a patient with Marfan syndrome or bicuspid aortic valve.
Clinically significant findings
Clinically significant findings
Pancreatic mass
Pancreatic neoplasm

Incidental Pancreatic Cyst

- **< 2 cm**
  - 1 yr follow up
  - Stable
  - Growth
  - No further FU

- **2-3 cm**
  - Characterization preferably MRI/MRCP

- **> 3 cm**
  - Serous Cystadenoma
    - Consider resection when > 4 cm
  - Uncharacterized mass or other cystic neoplasm

- **< 2 cm**
  - Benign
  - Yearly fu

- **2-3 cm**
  - BD-IPMT
    - Follow up every 6 mo for 2 years
  - Serous Cystadenoma
    - Follow up every 2 years

- **> 3 cm**
  - Cyst aspiration
    - Resect, depending on co-morbidity and risk
Clinically significant findings
Classic Hodgkin lymphoma
Clinically significant findings
Thyroid mass
Thyroid nodule on chest CT

Incidental Thyroid Nodule Detected on CT or MRI

- Suspicious CT or MRI findings
  - Limited life expectancy and comorbidities
    - Age <35 years
      - <1 cm: Evaluate with thyroid ultrasound
      - ≥1 cm: No further evaluation
    - Age ≥35 years
      - <1.5 cm: No further evaluation
      - ≥1.5 cm: Evaluate with thyroid ultrasound
  - General population

No suspicious CT or MRI findings

Managing Incidental Thyroid Nodules Detected on Imaging: White Paper of the ACR Incidental Thyroid Findings Committee
Is this cancer?
Lung screening 12 months earlier
Is this cancer?

Lung Screening CT

3 month follow-up

Department of Radiology and Radiological Sciences
Tuberculosis
Incidental findings in the VLSP

- Chart review performed of over 1200 patients enrolled in the VLSP
- 110 patients (9%) with incidental findings
- Appropriate follow-up rate of 81%
- Most common findings were renal lesions, aortic dilation, adenopathy, hepatic lesions, pulmonary fibrosis and thyroid nodules
- Multivariate logistic regression for follow-up performed for age, gender, race, education level and insurance status
<table>
<thead>
<tr>
<th>Variable</th>
<th>Appropriate Follow-Up</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Gender — no. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>48 (44)</td>
<td>14 (13)</td>
</tr>
<tr>
<td>Female</td>
<td>41 (37)</td>
<td>7 (9)</td>
</tr>
<tr>
<td>Race — no. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>77 (70)</td>
<td>18 (16)</td>
</tr>
<tr>
<td>Non-caucasian</td>
<td>12 (11)</td>
<td>3 (3)</td>
</tr>
<tr>
<td>Education Level — no. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School or Less</td>
<td>31 (28)</td>
<td>15 (14)</td>
</tr>
<tr>
<td>More than High School</td>
<td>58 (53)</td>
<td>6 (5)</td>
</tr>
<tr>
<td>Insurance Status — no. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicare</td>
<td>68 (62)</td>
<td>15 (14)</td>
</tr>
<tr>
<td>Commercial</td>
<td>21 (19)</td>
<td>6 (5)</td>
</tr>
</tbody>
</table>

\textsuperscript{a}Using Fisher's exact test of independence, education level was significant at $\alpha = 0.05$
Summary

• Screening saves lives: this service is available for those who qualify as high-risk for developing lung cancer

• Benefits outweigh risks for qualifying individuals

• Clinically significant incidental findings are expected on 10% of screening exams

• Radiologists should provide specific recommendations for follow up when possible
Thank you!

• Special thanks
  – Alexis Paulson, MSN, APRN, WHNP-BC, TTS, Clinical Coordinator of the Vanderbilt Lung Screening Program
  – Suraj Kapoor, Third Year VMS
  – Stephen Deppen, PhD
  – Cardiothoracic Imaging section members
  – Our referring providers!!