Incidentaloma on Chest CT

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I have no conflicts of interest to report
Incidentaloma
Pulmonary Nodule
Mediastinal Lymph Node
Coronary Artery Calcium
Incidental Nodule

• How big is the problem?
  • Jacobs 2008
    – Retrospective review of 11 publications: CAC (7) and lung cancer screening (4)
    – Clinically significant findings (required F/U) – 3% to 41%
    – 7.7% of CAD and 14.2% of Lung Cancer Screening studies required F/U
  • Hall 2009 - 589 pulmonary CTAs from ED at UNC
    – Pulmonary embolism – 9%
    – 24% incidental finding other than pe
    – 13% pulmonary nodule (of which as per guidelines 96% needed follow-up)
    – 9% - adenopathy
  • Swensen – Mayo Lung Cancer Screening
    – 69% - 1 or more positive findings in chest or abdomen after 3 years

Incidental Findings

Don’t Touch
Classically Benign
Benign Calcifications
Perifissural lymph node

- Lung CA screen population
- 28% NCN adjacent to fissure
- 0% - became CA

Ahn et al. Radiology. 2010
Incidental Findings

Touch!

Suspicious/Malignant
Worrisome Calcifications
Edge Characteristics
Lung Cancer/ TB?
Incidental Findings

Touch?
Indeterminate
Indeterminate Solid Nodule

What Next?
<table>
<thead>
<tr>
<th>Nodule size</th>
<th>Low-risk</th>
<th>High-risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 4mm</td>
<td>No follow-up</td>
<td>12 months</td>
</tr>
<tr>
<td>&gt; 4 - 6 mm</td>
<td>12 months</td>
<td>initial 6-12 months then 18-24 months</td>
</tr>
<tr>
<td>&gt; 6 - 8mm</td>
<td>initial 6 - 12 then 18 - 24</td>
<td>initial 3 - 6 months 9 - 12, final 24</td>
</tr>
<tr>
<td>&gt; 8mm</td>
<td>3, 9, and 24 dynamic, PET, bx</td>
<td>Same as for low risk</td>
</tr>
</tbody>
</table>

MacMahon et al. Radiology 237: 395-400, 2005
What next?

PET/CT
OR
8 weeks
Fleischner
NOT for Oncology Patients
## ACR LungRADS® - Solid Nodules

<table>
<thead>
<tr>
<th>Category</th>
<th>Category Descriptor</th>
<th>Findings</th>
<th>Fleischner</th>
<th>Management</th>
<th>Probability of Malignancy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Negative</strong></td>
<td>No nodules and definitely benign nodules</td>
<td>No lung nodules</td>
<td>≤ 4 mm</td>
<td>Continue annual screening with LDCT in 12 months</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td></td>
<td>Nodule(s) with specific calcifications: complete, central, popcorn, concentric rings and fat containing nodules</td>
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</tr>
<tr>
<td><strong>Benign Appearance or Behavior</strong></td>
<td>Nodules with a very low likelihood of becoming a clinically active cancer due to lack of size or growth</td>
<td>Solid nodule(s): &lt; 4 mm</td>
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<tr>
<td></td>
<td></td>
<td>New &lt; 4 mm</td>
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<tr>
<td></td>
<td></td>
<td>Category 3 or 4 nodules unchanged for ≥ 3 months</td>
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</tr>
<tr>
<td><strong>Probably benign</strong></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>Solid nodule(s): ≥ 6 mm to &lt; 8 mm at baseline OR</td>
<td>&gt; 4 mm – 6 mm</td>
<td>6 month LDCT</td>
<td>1-2%</td>
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<tr>
<td></td>
<td></td>
<td>new 4 mm to &lt; 6 mm</td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Non solid nodule(s) (GGN) ≥ 20 mm on baseline CT or new</td>
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</tr>
<tr>
<td><strong>Suspicious</strong></td>
<td>Findings for which additional diagnostic testing and/or tissue sampling is recommended</td>
<td>Solid nodule(s): ≥ 8 to &lt; 15 mm at baseline OR</td>
<td>&gt; 6 mm – 8 mm</td>
<td>Initial 3-6 month CT</td>
<td>&gt; 15%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>growing &lt; 8 mm OR</td>
<td></td>
<td>Chest CT with or without contrast; PET/CT and/or tissue sampling depending on the &quot;probability of malignancy and comorbidities; PET/CT may be used when there is a ≥ 8 mm solid component.</td>
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<tr>
<td></td>
<td></td>
<td>new 6 to &lt; 8 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Solid nodule(s) ≥ 15 mm OR</td>
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<tr>
<td></td>
<td>new or growing, and ≥ 8 mm</td>
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<tr>
<td></td>
<td>Category 3 or 4 nodules with additional features or imaging findings that increases the suspicion of malignancy</td>
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<tr>
<td></td>
<td>3,9,24 CT, PET, or bx</td>
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<td></td>
<td></td>
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</tbody>
</table>
Incidental Solid Nodule

What next?
Incidental Non Solid Nodule

What now?
## Pulmonary Nodule: Subsolid

### Solitary Lesion

<table>
<thead>
<tr>
<th>GGO</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 5-mm</td>
<td>No follow-up</td>
</tr>
<tr>
<td>&gt; 5 mm</td>
<td>Initial at 3 months (then annual for 3 or more years)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part solid</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial at 3 months. If persistent and solid component &lt; 5 mm, then yearly. If solid ≥ 5 mm, then biopsy/resect</td>
</tr>
</tbody>
</table>

### Multiple lesions

<table>
<thead>
<tr>
<th>GGO</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 5 mm</td>
<td>Follow up 2 – 4 years</td>
</tr>
<tr>
<td>&gt; 5 mm w/o dominant lesion</td>
<td>Initial at 3 months, then annual for minimum 3 years</td>
</tr>
</tbody>
</table>

| with dominant dominant | Initial 3 months, if persistent then biopsy, especially if solid > 5 mm |

Naidich. Radiology December, 2013
<table>
<thead>
<tr>
<th>Category</th>
<th>Category Descriptor</th>
<th>Findings</th>
<th>[Fleischner]</th>
<th>Management</th>
<th>Probability of Malignancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benign Appearance or Behavior</td>
<td>Nodules with a very low likelihood of becoming a clinically active cancer due to lack of size or growth</td>
<td>Part solid nodule(s): &lt; 6 mm total diameter on baseline screening Non solid nodules(s) (GGN): &lt; 20 mm OR ≥ 20 mm and unchanged or slowly growing</td>
<td>&lt; 5 mm</td>
<td>Continue annual screening with LDCT in 12 months</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td>Probably Benign</td>
<td>Probable benign finding(s) – short term follow up suggested; includes nodules with a low likelihood of becoming a clinically active cancer</td>
<td>Part solid nodule(s): ≥ 6 mm total diameter with solid component &lt; 6 mm OR new &lt; 6 mm total diameter Non solid nodule(s) (GGN) ≥ 20 mm on baseline CT or new</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suspicious</td>
<td>Findings for which additional diagnostic testing and/or tissue sampling is recommended</td>
<td>Part-solid nodule(s): GGO &gt; 5 mm Any PSN initial at 3 months; If persistent and solid &lt; 6 mm, then yearly</td>
<td></td>
<td>3 month LDCT; PET/CT may be used when there is a ≥ 8 mm solid component 6 month LDCT</td>
<td>5-15%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Part solid nodule(s) with a solid component ≥ 8 mm OR If solid ≥ 5 mm then biopsy</td>
<td></td>
<td>Chest CT with or without contrast; PET/CT and/or tissue sampling depending on the probability of malignancy and comorbidities; PET/CT may be used when there is a ≥ 8 mm solid component</td>
<td>&gt; 15%</td>
</tr>
</tbody>
</table>
Pulmonary Nodule: Subsolid

Category: 2 (GGN < 20mm)  4B (PSN Solid > 8mm)
Pulmonary Nodule: Subsolid
Incidental Nodule

- Review 1000 CTA chest CTs: Intermountain Health Care
- Rate of incidental nodule = 9.9% requiring follow-up
- Rate of appropriate follow-up when nodule noted
  - 29% underwent recommended follow-up; 0% when mentioned in findings of report only
- Affect of radiology report:
  - 68% reports had nodule follow-up recommendation
  - 20% in impression; 12% in findings only
    - When in impression with specific recommendations – 29% adherence
    - When in findings – 0% adherence

Blagev. JACR, 2014
Incidental Nodule: Conclusion

- Incidental Nodules are not rare
- Management
  - Most important - compare to prior studies
  - Recommendations in the Impression
- For non-oncology patients
  - Fleischner - solid nodule
  - Fleischner - GGO
  - ACR Incidental Chest White Paper - in development
- Oncology patients
  - 3 month short term follow-up
- Lung Cancer Screening
  - ACR LungRADS®
Incidental Mediastinal Lymphadenopathy

• How big is the problem?
  • Reported: 0.15 – 3%
    – Variety of CAC and lung CA screening CTs
  • Jacobs, 2008
    – Retrospective review of 11 CAD (7) and lung cancer screening (4) published studies
    – Lymphadenopathy: 1 – 6% of studies
  • Hall, 2009
    – 589 CTAs for pulmonary embolus
    – Positive = > 1cm node not associated with pneumonia; any > 3cm node; multiple nodes
    – Mediastinal – 29%; hilar – 7%
    – New adenopathy – 9% of cases

• Thymoma – SEER data = incidence 0.15 cases in 100,000
  – 0.6% of all thymic neoplasms; 0.2% of all malignancies

Marom ; Engles,. Int J Cancer 2003
Incidental Mediastinal Lymphadenopathy

- Stigt, 2011

  - Patients with at least one incidental ≥ 10 mm lymph node
  - N = 83; 10mm - > 30mm; EUS or EBUS
  - Results:
    - 64 – also hilar nodes
    - Lymphocytes – 55; sarcoid – 18; granuloma – 1; cyst – 1; mets – 1; inadequate - 7
  - Multiplicity, small size, coexistence with hilar lymphadenopathy
  - Incidental lymph nodes – mainly manifestation of reactive inflammation

Stigt et al. JTO, 2011
Mediastinal Lymph Nodes
Mediastinal Lymph Nodes
Staging - Lymph Nodes

Accuracy:

- CT 62 - 88%
- MR 50 - 82%
- PET 81 - 96%

## NSCLC - Lymph Nodes

### PET/CT (CT)

<table>
<thead>
<tr>
<th>Author</th>
<th>Journal</th>
<th>Year</th>
<th>Sens</th>
<th>Spec</th>
<th>Accur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yi</td>
<td>AJR</td>
<td>2007</td>
<td>56 (65)</td>
<td>100 (89)</td>
<td>90 (83)</td>
</tr>
<tr>
<td>Kim</td>
<td>Rad</td>
<td>2006</td>
<td>61</td>
<td>96</td>
<td>86</td>
</tr>
<tr>
<td>Antoch</td>
<td>Rad</td>
<td>2003</td>
<td>89 (70)</td>
<td>94 (59)</td>
<td>93 (63)</td>
</tr>
<tr>
<td>Birim</td>
<td>ATS</td>
<td>2005</td>
<td>90 (70)</td>
<td>90 (70)</td>
<td></td>
</tr>
</tbody>
</table>
Lymph Nodes: PET/CT
Incidental Mediastinal Lymphadenopathy

Conclusions:

• Size criteria: Not ideal, but the only reference
• In oncology patients
  – Consider the malignancy
    • Lung - Revised 8th edition TNM - # nodes
    • Esophageal, mesothelioma, lymphoma
    • Testicular, Renal, Breast, Melanoma
• In screening
  – Not uncommon – reactive nodes
• In non-oncological patients
  – Majority can be ignored – size > 10 cm
Incidental Coronary Artery Calcification

• How big is the problem?
  • 1965 - Fluoroscopy\(^1\) (for cardiac investigations) - 31%
  • 1997 - UK\(^2\)
    – 450 chest CTs - 26% of males, 15.6% of females; none in patients < 40 yrs old
  • Prospective Army Coronary Calcium (PACC)\(^3\)
    – 40 - 45 year old: prevalence – 17.3%
  • 2009 – Turkey\(^4\)
    – 113 thoracic CT, (31-92 yrs old; 72 male, 41 female)
    – CAC = 33%
  • 2010\(^5\) - 100 Consecutive CTAs
    – CAC detected on 46%

Incidental Coronary Artery Calcification

NLST:

- NLST (from 3856 death certificates)
  - Cardiovascular disease – 956 deaths [486 in CT group, 470 CXR group]
  - Lung cancer - 930 deaths [427 in CT group, 503 in CXR group]

- NLST – CAC study
  - Agatston 1 – 100, HR 1.27; mild HR 2.09
  - Agatston 101-1,000, HR 3.57, moderate HR 3.86
  - Agatston > 1000 , HR 6.63, heavy HR 6.95

Aberle & NLST Team, NEJM; Chiles. Radiology, In press
CAC Moderate
Incidental Coronary Artery Calcification

Conclusions:

- Numerous studies indicate CAC should be reported
- NLST
  - Report at least visual score – mild, moderate, heavy
Thoracic Incidentaloma

Thank You