Pulmonary Nodules and Lung Cancer Screening

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Objectives

• Understand the Fleishner Criteria for evaluating pulmonary nodules

• Review recommendations for Low Dose Chest CT Scan (LDCT) to screen for Lung Cancer
Lung Cancer is Terrible

• Annual death rate \( \approx \) Combined death rate (breast, prostate, colon, pancreas)
• Projected deaths in US 2012: 160,000
• Diagnosis commonly made at time of advanced disease...
  – Stage IV 40%
  – Stage III 30%
  – Stage III & IV combined 5 yr survival rate: < 16%
• Sputum cytology q 4mos ineffective early detection
• Chest x-ray screening fails to detect earlier stage lung cancer
  – PLCO Screening Trial (Oken et al, JAMA 2011)
  – Mortality unaffected by screening vs usual care
A 57-year-old man who has smoked one pack of cigarettes daily since the age of 15 undergoes low-dose CT (LDCT) of the chest for lung cancer screening. A single 4-mm solid nodule found in RLL which was not on a chest CT scan obtained 5 years earlier. No other abnormalities are noted. 

PMH: HTN, hyperlipidemia, mild COPD, & BPH.

In addition to facilitating smoking cessation, what is the most appropriate next step in evaluation and management?

1. No follow-up imaging or biopsy
2. Referral for biopsy
3. Combination positron-emission tomography and CT
4. LDCT of the chest in 12 months
5. Annual chest radiograph for 3 years
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NEJM Dec 2014
Lung Cancer Screening

Low Dose CT screening for lung cancer reduces mortality...

• True
• False
• Uncertain
Lung Cancer Screening

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Radiation Exposure from Medical Imaging

• Ionizing radiation exposure a/w increased risk for malignancy
• Medical Imaging radiation (CT, nuc med) increasing, as is public concern
• Background Ionizing radiation (sun, soil, cosmic) ~ 3 mSv/yr
• Chest Imaging procedures & ~Radiation (mSv)
  – Chest x-ray: 0.1
  – Std Chest CT: 7.0 (abdominal CT = 8, head CT = 2)
  – LDCT Chest : 1.4
  – Chest CT angio 16

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Pulmonary Nodules (Fleishner Criteria)

> 35 yo w/ <8 mm Incidentaloma on Chest CT

**Solid Nodules**

- **≤ 4 mm**  Low Risk persons: No f/u needed  
  High Risk persons: F/u CT in 12 months
- **>4-6 mm**  Low Risk: f/u CT in 12 months; no further if no change  
  High Risk: f/u CT in 6-12 months; then 18-24 mos if no change
- **>6-8 mm**  Low Risk: f/u CT 6-12 mos; then 18-24 mos if no change  
  High Risk: f/u CT 3-6 mos; then 9-12 & 24 mos if no change
- **>8 mm**  Either low or high risk  
  F/u CT at 3, 9, & 24 months  
  Further w/u: Dynamic contrast CT, PET and/or Bx

**Non-solid nodules:** Variable f/u recommendations

- **Low risk patients:** Minimal or absent history of smoking &/or other known risk factors
- **High risk patients:** H/o smoking or other RF (e.g. exposure to asbestos, radon, uranium, or first degree relative w/ lung CA)

Low-dose CT & Lung Ca Screening

NLST (National Lung Screening Trial)
NEJM 2011;365:395-409

• RCT, N = 53,454, age 55-75, >30 pk yr (quit < 15 yr) smokers; Multiple US Ca Centers

Low-dose Chest CT (LDCT)

vs

Chest X-ray

• Yearly radiographs x 3 years
  F/u additional 3.5 years

• >4 mm non-calcified mass (Fleishner) → more w/u
LDCT Screening Reduces Mortality

- 20% (CI, 6.8-26.7) ↓ Lung CA mortality; 6.7% (CI 1.2-13.6) ↓ Overall
- 32%: Suspicious lesion(s) on LDCT, which were not cancer
  - 457 (2.7%) invasive procedure, 11 (0.06%) major complication

NLST. NEJM 2011;365:395-409
# LDCT Screen & Lung Ca Mortality
## Comparative Data (8 RCT, 13 Cohort studies)

<table>
<thead>
<tr>
<th>Trial (N)</th>
<th>LDCT</th>
<th>Control</th>
<th>RRR(CI)</th>
<th>NNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NLST (53454)</td>
<td>1.3%</td>
<td>1.7%*</td>
<td>20% (7 to 27)</td>
<td>320</td>
</tr>
<tr>
<td>DANTE (2472)</td>
<td>1.6%</td>
<td>1.7%+</td>
<td>3% (-32 to 29)</td>
<td>NS</td>
</tr>
<tr>
<td>DLCST (4104)</td>
<td>0.7%</td>
<td>0.5%+</td>
<td>15% (-17 to 61)</td>
<td>NS</td>
</tr>
</tbody>
</table>

* Chest X-ray; + Standard Care

- ~20% reveal “significant nodule”, >95% turn out benign; Leads to...
  - Additional radiation (Chest CT, PET scans)
  - Surgical biopsy (1-4%): mostly benign lesions, complication rare, but variable
- Consensus recommendation: Cancer Center & Strict selection criteria


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LDCT Screening for Lung Ca?

- Recommend adherence to specific criteria...
  - Strict selection (aged 55-80 and significant smoking history)
  - Patients committed to annual f/u & additional testing
  - Rigorous, but judicious work-up of positives
  - Clinics with track record in lung nodule screening (eg, Designated Cancer Centers)

- Caution/Risks:
  - Patients may use negative result to justify continued smoking...
    Data: Screening outcome has minimal impact on smoking behavior (Tammemagi et al JNCI 2014, Ashraf et al Thorax 2014)
  - Keeping patient anxiety c/w data (>95% of lesions are benign)
  - Recent subgroup analysis: Pt >65 more malignant lesions detected early vs 55-65 cohort, but rate of procedure related complications higher (Pinskey et al, Ann Int Med Sept 2014)
  - Uncertainty: Scan annually after 3 years? How long?
  - Up to 33% cases lead to additional w/u → increased risk (eg, Radiation, unnecessary surgery)
Take Home Points

- Asymptomatic 55-80 yo M & F, ≥30 pk yr current smoker or quit w/in 15 years:
  - Screen annually w/ LDCT preferably at a Lung nodule screening clinic (ie, UI IRL or ICVA)
  - Discontinue when pt >15 years
- Smoking cessation remains most potent Lung Ca prevention
- Plain Chest x-ray screening is totally ineffective
Low-dose CT & Lung Ca Screening References

- NLST: Reduced lung-cancer mortality with low-dose computed tomographic screening. NEJM 2011;365:395-409
- USPSTF Screening for Lung Cancer http://www.uspreventiveservicestaskforce.org
Be Happy…

The End!