Fitting the NCCN Lung Cancer Screening Guidelines (Version 1.2015) to the ACR Lung-RADS Version 1.0 Assessment Categories

Eric M. Hart, MD

**Disclosures**

I have no financial conflicts of interest to disclose.

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Any opinions expressed are solely my own.

**NCCN Guidelines (Version 1.2015)**

- Release date 7-21-14
- Algorithms for risk assessment (1), categorization of screening findings (1), and evaluation/follow-up of screening findings (4), including 21 footnotes (a-u)
- Table of recommendations for CT acquisition, storage, interpretation and nodule reporting
- Lists of screening risks and benefits

**NCCN Guidelines (Version 1.2015)**

- The major differences from Version 1.2014 are:
  - Addition of a requirement for shared decision making (including a risk and benefit discussion) for patients eligible for screening [LCS-1]
  - Footnote "i" is added: "Strongly recommend standardized reporting (http://www.acr.org/Quality-Safety/Resources/LungRADS)." [LCS-2]
  - A change in the second high risk group (age ≥ 50; ≥ 20 pack-years; 1 additional risk factor except second hand smoke) from category 2B to category 2A [LCS-1]
  - No changes to nodule cutoff sizes or follow-up recommendations

**ACR Lung-RADS Version 1.0**

- Release date 4-28-14
- 5 major findings/results categories (0-4) with descriptors, management recommendations, and estimates of malignant probability and population prevalence for each category
- 2 Modifiers (S/C)
- 13 Footnotes
- 1 Link out (McWilliams et al lung cancer risk calculator)

**My Goal**

- Compare results categories and follow up recommendations between ACR-LR-V1 and NCCN V1.2015 (initial screens)
- Emphasize similarities between the 2 systems
- Point out differences between the 2 systems
- Suggest potential alternatives/compromises to bridge the gaps
## Let's Have Some Fun!

### Screening Finding: No Lung Nodules
- **NCCN Guideline:**
  - LCS-2: No nodules
- **Lung-RADS Category:**
  - 1 (Negative)
- **Management:**
  - Annual LDCT for 2 years
  - Suggest annual LDCT until patient no longer eligible for definitive RX

### Management:
- Repeat screening in 12 months

### Screening Finding: Definitely Benign Nodules (Benign Ca++ Pattern; Fat [Hamartoma])
- **NCCN and Lung-RADS are functionally equivalent**
  - “Negative Screen”
- **Management:**
  - Repeat screening in 12 months

### Question:
At what time point does a pre-existing solid nodule become definitely benign?
- 1 year?
- 2 years?
- 5 years?
- Never?

### Screening Finding: Solid or Part Solid Nodule <6 mm (Initial Screen)
- **NCCN Guideline:**
  - LCS-3: Solid or part solid nodule
    - < 6mm (all)
- **Lung-RADS Category:**
  - 2 (Benign Appearance or Behavior)
  - <6 mm (all)
- **Management:**
  - Annual LDCT for 2 years
  - Suggest annual LDCT until patient no longer eligible for definitive RX

### Management:
- Annual LDCT screening
Screening Finding: Solid or Part Solid Nodule

- 6-8 mm (Initial Screen)

**NCCN Guideline:**
- LCS-3: Solid or part solid nodule
  - 6-8 mm (all)

**Management:**
- F/U LDCT in 3 months

**Lung-RADS Category:**
- 4A (Suspicious)
  - 8 mm (solid)
  - 7 or 8 mm PSN with 6 or 7 mm solid component

**Management:**
- F/U LDCT in 3 months
  - Not specified
  - No growth
  - Recategorize (Cat. 2)
  - RTS (12 months)

**An Artful Compromise Solution?**
- "Indeterminate" screen result (all 6-8 mm nodules) with follow up recommendations based on your evaluation of the radiographic suspicion of the nodule in question
  - "Refer to the system (NCCN or Lung-RADS) driving the follow up recommendations"

**Screening Finding: Solid or Part Solid Nodule >8 mm (Initial Screen)**

**NCCN Guideline:**
- LCS-3: Solid or part solid nodule
  - >8 mm (all)

**Management:**
- Consider PET/CT
  - Low suspicion of cancer
    - F/U LDCT in 3 months
    - No growth
  - F/U LDCT in 6 months
  - RTS (12 months) if stable

**Lung-RADS Category:**
- 4A (Suspicious)
  - 9-14 mm (solid)

**Management:**
- F/U LDCT in 3 months
  - PET/CT may be used when the solid component is >8 mm
    - Growth (>1.5 mm)
    - Not specified
    - No growth
    - Recategorize (Cat. 2)
    - RTS (12 months)

Screening Finding: Solid or Part Solid Nodule

- <6 mm (Initial Screen)

**NCCN and Lung-RADS are functionally equivalent for the initial screen finding of a solid or part solid nodule <6 mm**
- "Benign Appearance or Behavior" as the screen result?
- "Negative Screen" as the result and include a disclaimer about benign behavior based on local statistics?

**Management:**
- Repeat screening in 12 months

**Question:** At what time point does a pre-existing part solid nodule become definitely benign?
- 1 year?
- 2 years?
- 5 years?
- Never?

**Screening Finding: Solid or Part Solid Nodule 6-8 mm (Initial Screen)**

**NCCN Guideline:**
- LCS-3: Solid or part solid nodule
  - 6-8 mm (all)

**Management:**
- F/U LDCT in 3 months
  - Growth (>2 mm)
  - Resection
  - No growth
  - F/U LDCT in 6 months
  - Resect for growth
  - RTS (12 months) if stable

**Lung-RADS Category:**
- 3 (Probably Benign)
  - 6-7 mm (solid)
  - 6-8 mm PSN with solid component <6 mm

**Management:**
- F/U LDCT in 6 months
  - Growth (>1.5 mm)
  - Not specified
  - No growth
  - Resequence (Cat. 2)
  - RTS (12 months)

**Screening Finding: Solid or Part Solid Nodule 6-8 mm (Initial Screen)**

**NCCN and Lung-RADS differ for the initial screen finding of a 6-8 mm solid or part solid nodule**
- Lung-RADS parses the category into smaller subcategories
- NCCN guidelines are in general more conservative (shorter initial follow up interval in most cases; 2 follow up exams prior to RTS)
- Lung-RADS treats the 8 mm solid nodule and the 6-8 mm PSN with a 6-7 mm solid component as potentially more aggressive lesions, with initial follow up similar to NCCN
- The definition of interval growth is slightly different between the 2 systems

**Screening Finding: Solid or Part Solid Nodule >8 mm (Initial Screen)**

**NCCN Guideline:**
- LCS-3: Solid or part solid nodule
  - >8 mm (all)

**Management:**
- Consider PET/CT
  - Low suspicion of cancer
    - F/U LDCT in 3 months
    - No growth
    - F/U LDCT in 6 months
    - RTS (12 months) if stable

**Lung-RADS Category:**
- 4A (Suspicious)
  - 9-14 mm (solid)

**Management:**
- F/U LDCT in 3 months
  - PET/CT may be used when the solid component is >8 mm
    - Growth (>1.5 mm)
    - Not specified
    - No growth
    - Resequence (Cat. 2)
    - RTS (12 months)
Screening Finding: Solid or Part Solid Nodule
>8 mm (Initial Screen)

- **NCCN Guideline:**
  - LCS-3: Solid or part solid nodule
    - >8 mm (all)
- **Management:**
  - Consider PET/CT
  - Low suspicion of cancer
  - Biopsy or Excision
  - if not cancer, RTS (12 mo)

- **Lung-RADS Category:**
  - 4B (Suspicious)
    - >15 mm (solid)
- **Management:**
  - Consider PET/CT
    - Suspicion of cancer
      - Biopsy or Excision
      - if not cancer, RTS (12 mo)

- **NCCN Guideline:**
  - LCS-3: Solid or part solid nodule
    - >8 mm (all)
- **Management:**
  - Consider PET/CT
    - Suspicion of cancer
    - Biopsy or Excision
    - if not cancer, RTS (12 mo)

- **Lung-RADS Category:**
  - 3 (Probably Benign)
    - 9 mm or larger PSN with a solid component <6 mm
- **Management:**
  - F/U LDCT in 6 months
    - Growth (>1.5 mm)
    - Not specified
    - No growth
      - Recategorize (Cat. 2)
      - RTS (12 months)

**Screening Finding: Solid or Part Solid Nodule**
>8 mm (Initial Screen)

- **NCCN Guideline:**
  - LCS-3: Solid or part solid nodule
    - >8 mm (all)
- **Management:**
  - Consider PET/CT
    - Suspicion of cancer
    - Biopsy or Excision
    - if not cancer, RTS (12 mo)

- **Lung-RADS Category:**
  - 4B (Suspicious)
    - 9 mm or larger PSN with a solid component >6 mm
- **Management:**
  - Diagnostic Chest CT, PET/CT (>8 mm soft tissue component), and/or tissue sampling

**Screening Finding: Solid or Part Solid Nodule**
>8 mm (Initial Screen)

- **NCCN and Lung-RADS differ for the initial screen finding of a >8 mm solid or part solid nodule**
  - Lung-RADS parses the category into smaller subcategories
  - Lung-RADS treats the 8-14 mm solid nodule slightly less aggressively than do the NCCN guidelines (3 month F/U LDCT)
  - NCCN guidelines are in general more aggressively directed to diagnosis and staging for smaller nodules in this range (PET/CT for all)
  - NCCN guidelines are not clear on how to handle the PSN with <8 mm solid component (see footnote n)

- **NCCN and Lung-RADS differ for the initial screen finding of a >8 mm solid or part solid nodule**
  - “Suspicious” screen result for all

- **A Compromise Management Solution:**
  - Solid nodules get recommendations based on your evaluation of the radiographic suspicion of the nodule in question (size/margin/location/other)
  - Reference the system (NCCN or Lung-RADS) driving the follow up recommendation
### Screening Finding: Solid or Part Solid Nodule >8 mm (Initial Screen)

- NCCN and Lung-RADS differ for the initial screen finding of a >8 mm solid or part solid nodule
- "Suspicious" screen result for all

**A Compromise Management Solution:**
- 9 mm or larger PSN with:
  - <6 mm solid component: 6 month LDCT per Lung-RADS (Category 3)
  - 6-7 mm solid component: 3 month LDCT per Lung-RADS (Category 4A)
  - 8 mm or larger solid component: PET/CT per NCCN Guidelines/Lung-RADS (Category 4B)

### Screening Finding: Solid Endobronchial Nodule (Initial Screen)

- NCCN and Lung-RADS differ for the initial screen finding of a solid endobronchial nodule
- NCCN guidelines are aggressively directed to diagnosis for endobronchial nodules (bronchoscopy for persistence at 1 month)
- Lung-RADS treats the solid endobronchial nodule less aggressively (3 month FU LDCT; RTS @ 12 months for persistence)

**My Opinion:** NCCN guidelines are more closely aligned with the standard of practice in my institution

### Screening Finding: Ground Glass Nodule 5 mm (Initial Screen)

- NCCN Guideline:
  - LCS-4: GGO/GGN/NS (non-solid nodule)
  - <5 mm
- Management:
  - LDCT in 12 months
  - Stable
  - Annual LDCT for 2 years
  - Growth or change to PSN:
    - LDCT in 3-6 months, or
    - Consider surgical excision
  - RTS (12 mo) if not cancer

- Lung-RADS Category:
  - 2 (Benign Appearance or Behavior)
  - <20 mm
- Management:
  - Annual LDCT screening

### Screening Finding: Ground Glass Nodule 6-10 mm (Initial Screen)

- NCCN Guideline:
  - LCS-4: GGO/GGN/NS (non-solid nodule)
  - 6-10 mm
- Management:
  - LDCT in 6 months
  - Stable
  - Annual LDCT for 2 years

- Lung-RADS Category:
  - 2 (Benign Appearance or Behavior)
  - <20 mm
- Management:
  - Annual LDCT screening
Screening Finding: Ground Glass Nodule 5-10 mm (Initial Screen)

- **NCCN Guideline:**
  - LCS-4: GGO/GGN/NS (non-solid nodule)
    - 6-10 mm
- **Management:**
  - LDCT in 6 months
    - Growth or change to PSN
      - Surgical excision
    - RTS (12 mo) if not cancer

- **Lung-RADS Category:**
  - 2 (Benign Appearance or Behavior)
  - >20 mm
- **Management:**
  - Annual LDCT screening

Screening Finding: Ground Glass Nodule >10 mm (Initial Screen)

- **NCCN Guideline:**
  - LCS-4: GGO/GGN/NS (non-solid nodule)
    - >10 mm
- **Management:**
  - LDCT in 6 months
    - Growth or change to PSN
      - Surgical excision
    - RTS (12 mo) if not cancer

- **Lung-RADS Category:**
  - 2 (Benign Appearance or Behavior)
  - >20 mm
- **Management:**
  - Annual LDCT screening

Screening Finding: Ground Glass Nodule >10 mm (Initial Screen)

- **NCCN Guideline:**
  - LCS-4: GGO/GGN/NS (non-solid nodule)
    - >10 mm
- **Management:**
  - LDCT in 3-6 months
    - Stable
    - Annual LDCT for 6-12 months
    - Biopsy
    - Consider surgical excision
    - RTS (12 mo) if not cancer

- **Lung-RADS Category:**
  - 2 (Benign Appearance or Behavior)
  - <20 mm
- **Management:**
  - Annual LDCT screening

Screening Finding: Ground Glass Nodule (Initial Screen)

- **A Potential Compromise Management Solution:**
  - Use Lung-RADS ground glass nodule recommendations for all solitary GGNs ≤10 mm
    - Category 2
    - Annual LDCT screen
  - Use the NCCN 6-10 mm GGN guideline for all solitary GGNs >10 mm
    - 6 month LDCT
    - Effectively makes a GGN > 10 mm Lung-RADS Category 3 on initial detection

- **Screening Finding: Multiple Ground Glass Nodules (Initial Screen)**

- **NCCN Guideline:**
  - LCS-5: Multiple GGO/GGNs/NS
    - Pure GGNs ≤5 mm
- **Management:**
  - LDCT in 12 months
    - Stable
    - Annual LDCT for 2 years
    - Biopsy if >10 mm
    - RTS (12 months) if not cancer

- **Lung-RADS Category:**
  - 2 (Benign Appearance or Behavior)
  - ≤20 mm (single or multiple)
- **Management:**
  - Annual LDCT screening

Screening Finding: Ground Glass Nodule >10 mm (Initial Screen)

- **NCCN and Lung-RADS differ significantly for the initial screen finding of a ground glass nodule**
  - NCCN Guidelines parse the category into smaller subcategories
  - NCCN guidelines are in general more aggressive with respect to follow up of ground glass nodules, particularly all "intermediate" sized GGNs

- **My Opinion:** NCCN guidelines are more closely aligned with the standard of practice in my institution for ground glass nodules larger than 10 mm
Screening Finding: Multiple Ground Glass Nodules (Initial Screen)

- **NCCN Guideline:**
  - LCS-5: Multiple GGO/GGNs/NSs
  - Pure GGNs >5 mm (without dominant lesion)

- **Management:**
  - LDCT in 6 months
  - Growth or change to PSN
  - Consider surgical resection
  - Consider annual LDCT until patient no longer eligible for definitive Rx if not cancer

- **Lung-RADS Category:**
  - 2 (Benign Appearance or Behavior)
  - <20 mm (single or multiple)

- **Management:**
  - Annual LDCT screening

Screening Finding: Multiple Ground Glass Nodules (Initial Screen)

- **NCCN Guideline:**
  - LCS-5: Multiple GGO/GGNs/NSs
  - Dominant nodule(s) with part solid or solid component

- **Management:**
  - LDCT in 3-6 months
  - Persistence or growth
  - As per LCS-5

- **Management:**
  - Annual LDCT screening

Screening Finding: New Nodule at Annual or Follow Up LDCT

- **NCCN Guideline:**
  - LCS-6: New nodule
  - Defined as ≥3 mm

- **Management:**
  - Suspected inflammation
    - Treadmill or FLAIR (1-2 months)
  - No suspected inflammation
    - Solid/PSN: LCS-3
    - GGO/GGN/NS: LCS-4
    - Multiple GGN: LCS-5

- **Lung-RADS Category:**
  - 2, 3, 4A, or 4B
  - Depends on nodule size and solid component size if PSN

- **Management:**
  - Depends on category
Screening Finding: Other Potentially Significant Findings

- **NCCN Guideline:**
  - LCS-2: Findings requiring follow up for diseases other than lung cancer
- **Management:**
  - Not specified

- **Lung-RADS Category:**
  - S (Other)
  - Modifier—can be added to any Category (0-4)
- **Management:**
  - As appropriate to the specific finding

Lung-RADS Version 1.0

**Category 0 (Incomplete)**

- **Category Descriptor:**
  - None provided
- **Findings:**
  - Part or all of lungs cannot be evaluated
  - Prior CT’s being loaded for comparison
- **Management:**
  - Get additional images or do the comparison
- **Malignant Probability:**
  - N/A
- **Est. Pop. Prevalence:**
  - 1%

**Category 4X (Suspicious)**

- **Category Descriptor:**
  - Findings for which additional diagnostic testing or tissue sampling is recommended
- **Findings:**
  - Category 3 or 4 nodules with additional feature or imaging findings that increases the suspicion of malignancy
- **Management:**
  - Diagnostic CT, PET/CT, or tissue sampling
- **Malignant Probability:**
  - > 15% (all category 4 lesions combined)
- **Est. Pop. Prevalence:**
  - 2%
In Summary

NCCN and Lung-RADS Functional Concordance

- No nodules (Lung-RADS Category 1 [Negative])
- Definitely benign nodules (Lung-RADS Category 1 [Negative])
- Small nodules:
  - <6 mm solid (Lung-RADS Category 2 [Benign Appearance or Behavior])
  - <6 mm part solid (Lung-RADS Category 2 [Benign Appearance or Behavior])
  - 6 mm (6 mm) ground glass (Lung-RADS Category 2 [Benign Appearance or Behavior])

- In practice these will likely represent 80% of your initial screen results

Management: Annual repeat LDCT

Opinion:
- In my practice I define all of these studies as a "Negative Screen", and issue a disclaimer that tiny nodules (when present) are both common in my geographic area and overwhelmingly benign.

NCCN and Lung-RADS Functional Discordance

- Some "medium sized" nodules
  - 8 mm solid (Lung-RADS Category 4A [Suspicious])
  - 7 or 8 mm part solid with a 6 or 7 mm solid component (Lung-RADS Category 4A [Suspicious])

- In practice this will likely represent <5% of your initial screen results

Management: Follow up LDCT in 3 months (PET/CT as an alternate for the 8 mm solid nodule)

My Compromise Solution:

- In my practice I define all "medium sized" (6-8 mm) nodules as an "Indeterminate Screen"
- My follow up recommendations vary from 3-6-12 months to PET/CT depending on my degree of suspicion based on nodule appearance/margins/location etc.

- I specifically reference in the report which system I am using to drive the follow up recommendation

NCCN and Lung-RADS Functional Concordance

- Some "large" nodules
  - 9-14 mm solid (Lung-RADS Category 4A [Suspicious])
  - 15 mm solid (Lung-RADS Category 4B [Suspicious])
  - 9 mm part solid with a 8 mm solid component (Lung-RADS Category 4B [Suspicious])

- In practice this will likely represent <5% of your initial screen results

Management:
- NCCN: Consider PET/CT
- Lung-RADS: Diagnostic CT, or PET/CT, or tissue sampling

NCCN and Lung-RADS Functional Discordance

- Other "medium sized" nodules
  - 6-7 mm solid (Lung-RADS Category 2 [Benign])
  - 6-7 mm part solid with a <6 mm solid component (Lung-RADS Category 3 [Probably Benign])

- In practice this will likely represent <5% of your initial screen results

Management:
- Follow up LDCT in 3 months (NCCN: solid/part solid)
- Follow up LDCT 6 months (Lung-RADS: solid part solid)
- 6-8 mm ground glass (Lung-RADS Category 2 [Benign Appearance or Behavior])

- Management:
  - Follow up LDCT in 6 months (NCCN: ground glass)
  - Follow up LDCT 12 months (Lung-RADS: ground glass)

NCCN and Lung-RADS Functional Discordance

- Other "large" nodules
  - 9 mm part solid with a <6 mm solid component (Lung-RADS Category 3 [Probably Benign])

- Management:
  - Consider PET/CT (NCCN) although they acknowledge low PET sensitivity if the solid component <8 mm
  - Follow up LDCT 6 months (Lung-RADS)

- 9 mm part solid with a 6-7 mm solid component (Lung-RADS Category 4A [Suspicious])

- Management:
  - Consider PET/CT (NCCN) although they acknowledge low PET sensitivity if the solid component <8 mm
  - Follow up LDCT 3 months (Lung-RADS)

- 9-20 mm ground glass (Lung-RADS Category 2 [Benign Appearance or Behavior])

- Management:
  - 8-10 mm: Follow up LDCT 6 months (NCCN)
  - 11-20 mm: Follow up LDCT 3-6 months (NCCN)

- Annual rescreen (Lung-RADS)

- 20 mm ground glass (Lung-RADS Category 3 [Probably Benign])

- Management:
  - Follow up LDCT 3-6 months (NCCN)
  - Follow up LDCT 6 months (Lung-RADS)
In Summary

• NCCN and Lung-RADS Functional Discordance
  • Solid endobronchial nodules (Lung-RADS Category 4A [Suspicious])
  • In practice this will likely represent < 1% of your initial screen results

• Management:
  • Repeat LDCT 1 month (NCCN): Bronchoscopy for persistence
  • Follow up LDCT 3 months (Lung-RADS): RTS (12 months) for persistence

• Opinion:
  • This should be harmonized to the NCCN management scheme

In Summary

• NCCN and Lung-RADS Functional Concordance

• Other potentially significant findings
  • Separate results category as diagrammed by NCCN (LCS-2)
  • “S” modifier in Lung-RADS
  • Can be added to any result category (0-4)

• Opinion
  • Report templates should be adaptable enough to for other significant findings to function as the primary result (e.g. suspected lymphoma), or as an add-on to the primary lung cancer screening result

• Management: As appropriate to the both the lung screen result and the specific abnormality

In Summary

• Opinion:
  • NCCN may have over-parsed the GGN group
  • Lung-RADS may have over-parsed the part-solid nodules and the large nodules
  • Lung-RADS may have under-parsed the ground glass nodules
  • Lung-RADS may have gotten endobronchial nodules wrong
  • These represent the areas of greatest opportunity for harmonization

In Summary

• One more thing:
  • Let's get our < > and ≥ ≤ signs all in the same place!

Thank You!

Northwestern University Feinberg School of Medicine
Department of Radiology
radiology.northwestern.edu

Eric M. Hart, MD (ehart@nmff.org)