

JAMA Clinical Guidelines Synopsis

Incidental Pulmonary Nodules Detected on CT Images

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GUIDELINE TITLE Guidelines for Management of Incidental Pulmonary Nodules Detected on CT Images: From the Fleischner Society

DEVELOPER AND FUNDING AGENCY Fleischner Society

RELEASE DATE July 2017

PRIOR VERSION Solid nodules (2005); semisolid nodules (2013)

TARGET POPULATION Patients with incidental pulmonary nodules detected on computed tomography (CT) images

MAJOR RECOMMENDATIONS AND RATINGS

- Prior imaging studies should always be reviewed whenever available (grade 1A; strong recommendation; high-quality evidence)

- Solid nodules <6 mm do not require routine follow-up in low-risk patients (grade 1C; strong recommendation).
- For pure ground-glass nodules (GGNs) <6 mm, no routine follow-up is recommended (grade 1B; strong recommendation)
- Some solid nodules <6 mm with suspicious morphology, upper lobe location, or both may pose higher risk and warrant follow-up at 12 months (grade 2A; weak recommendation).
- For solitary solid noncalcified nodules measuring 6 to 8 mm in patients at high risk, an initial follow-up examination is recommended at 6 to 12 months and again at 18 to 24 months (grade 1B; strong recommendation; moderate-quality evidence)
- For solitary solid noncalcified nodules >8 mm in diameter, consider 3-month follow-up, workup with combined positron emission tomography (PET) and CT, tissue sampling, or a combination thereof (grade 1A; strong recommendation; high-quality evidence).

Summary of the Clinical Problem

An incidental lung nodule on CT scan can create uncertainty for clinicians and anxiety for patients and families, given that lung cancer is the leading cause of cancer mortality in the United States. Incidental lung nodules are not uncommon. A systematic review of CT screening lung cancer trials noted that a lung nodule was detected in up to 51% of study participants.¹ More than 95% of detected nodules are benign and have a wide variety of causes, including infections, granulomatous disease, hamartomas, arteriovenous malformations, round atelectasis, and lymph nodes.

Characteristics of the Guideline Source

The Fleischner Society is an international multidisciplinary society that publishes standards, guidelines, and consensus statements on the diagnosis and treatment of chest diseases. In 2017, the society published updated guidelines for the management of incidental pulmonary nodules detected on CT images in adults aged 35 years or older (Table).² The new guidelines offer more precise recommendations based on patient risk, the number of nodules (single vs multiple), and the subtyping of subsolid nodules (GGN vs partly solid); discuss additional risk factors for malignancy; and add flexibility regarding follow-up imaging (Figure).

Evidence Base and Discussion

Risk Stratification: High- vs Lower-Risk Patients

High-risk lung nodules are defined by the American College of Chest Physicians as nodules with an estimated cancer risk of at least 65%.³ High-risk patient factors include older age and heavy smoking, while high-risk nodule features include larger nodule size, irregular or spiculated margins, and upper lobe location. Low-risk nodules are defined as having an estimated risk of cancer of less than 5% and are associated with young age and less smoking, along with smaller

size, regular margins, and location in an area other than the upper lobe. Nodules at intermediate risk have mixed low- and high-risk characteristics, which may include other higher-risk factors such as emphysema and pulmonary fibrosis, positive family history, and known exposure to inhaled carcinogens. For the purposes of the Fleischner recommendation table, nodules with intermediate-risk estimations of 5% to 65% were combined with the high-risk category.

General Imaging Recommendations

Appropriate CT imaging protocols are necessary to accurately characterize the nodule, reduce cumulative radiation exposure, and assess any changes in nodule size or characteristics. The authors made 3 grade 1A, strong recommendation, high-quality evidence ratings in this category: use of 1-mm thin cuts, low-dose radiation protocols, and routine comparison with prior CT scans.

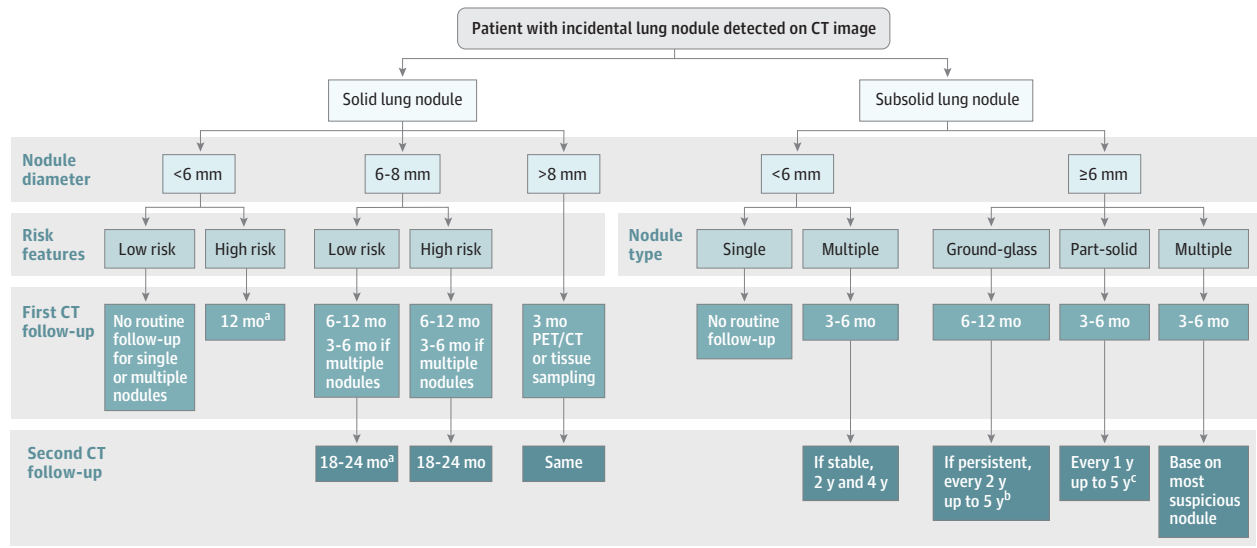
Nodule Characteristics: Solid, Partly Solid, and GGN

Solid lung nodules are round or irregular opacities with a mean axial diameter of 0.3 to 3.0 cm and homogeneous soft-tissue

Table. Guideline Rating

Standard	Rating
Establishing transparency	Fair
Management of conflict of interest in the guideline development group	Good
Guideline development group composition	Fair
Clinical practice guideline-systematic review intersection	Fair
Establishing evidence foundations and rating strength for each of the guideline recommendations	Fair
Articulation of recommendations	Good
External review	Fair
Updating	Fair
Implementation issues	Fair

Figure. Algorithmic Approach to Follow-up of Incidental Pulmonary Nodules

Adapted from the 2017 Fleischner guideline summary recommendation table.²^a Optional, but consider all relevant risk factors.^b If growth, or if a solid component grows or develops, consider resection.^c If persistent/stable and solid component remains <6 mm. If solid component is >6 mm or grows, treat as highly suspicious. PET/CT, biopsy, or resection if solid component >8 mm.

attenuation at CT that completely obscure the underlying bronchial and vascular margins. Subsolid nodules are round or irregular opacities with a mean axial diameter of 0.3 to 3.0 cm and pure ground-glass or partly solid attenuation on CT that do not completely obscure underlying structures.⁴ Ground-glass nodules smaller than 6 mm have a high prevalence, are often transient, and are usually related to infection or hemorrhage. Persistent GGNs carry a higher risk of malignancy. Partly solid nodules have a high risk of malignancy, but if the solid component is smaller than 6 mm, they are less likely to be aggressive, such as adenocarcinoma in situ or minimally invasive adenocarcinoma. Partly solid nodules with a solid component of at least 6 mm require either close follow-up or, for high-risk lesions, further evaluation (PET, biopsy, surgical removal). In a study by Henschke et al,⁵ partly solid nodules were malignant in 63%, pure GGNs in 18%, and solid nodules in only 7%.

Multiple Nodules

For multiple solid nodules with at least 1 nodule of 6 to 8 mm or larger than 8 mm, the most suspicious nodule should determine

follow-up. In general, earlier follow-up CT is advised (vs similarly sized solitary solid nodules), given a higher concern for metastatic disease. For multiple subsolid nodules smaller than 6 mm, CT should be repeated in 3 to 6 months and, if nodules persist, every 2 years for 5 total years, given a higher likelihood of atypical adenomatous hyperplasia and adenocarcinoma in situ. When there are multiple subsolid nodules with at least 1 nodule larger than 6 mm, CT should be repeated in 3 months and further monitoring should be dictated by the larger or most suspicious nodule(s) and whether nodules persist (higher likelihood of multiple primary adenocarcinomas).

Related guidelines and other resources

Fleischner Society nodule description and measurement guidance

Lung nodule cancer risk calculators: [Brock University](#); [NPS-BIMC](#)

ARTICLE INFORMATION

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Conflict of Interest Disclosures: Both authors have completed and submitted the ICMJE Form for

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