

Evidence Discussion (CH16.2)

Incidental Pulmonary Nodules Detected on CT Images Evidence Summary

A pulmonary nodule is defined as a well or poorly defined rounded opacity < 3 cm in diameter. The Fleischner Society guidelines for the management of incidental pulmonary nodules detected on CT were last updated in 2017.(1) The purpose of the guidelines is to minimize both the number of unnecessary follow up exams and the chance of a malignancy advancing in stage during CT follow up prior to diagnosis. Surveillance is most appropriate if there is a very low probability of cancer or a high risk of complications from surgery or biopsy.(2) It is important to establish the clinical probability of malignancy before ordering imaging.(1,2,3) The Fleischner guidelines are not intended to apply to people younger than 35, people with known primary cancers at risk of metastases or to immunocompromised people at risk of infection. They do not apply to patients with unexplained fever or respiratory symptoms.(4) For patients younger than 35, lung cancer is rare. Management should be on a case by case basis, and the use of serial CT's should be minimized.(1)

Solid nodules < 6 mm do not require follow up in patients at low risk of lung cancer or in all patients at high risk. Nodules which have a suspicious morphology or an upper lobe location may be followed up with a CT in 12 months. Solid nodules 6-8 mm may be followed with a CT at 6-12 months in low risk patients with a further follow up at 18-24 months in high risk patients. Two follow up CT's should be sufficient to rule out growth in most patients.

For solid nodules > 8 mm, the options are CT surveillance, an FDG PET/CT, tissue sampling or a combination of these. Surveillance CT scans for solid nodules > 8 mm may be done at 3 months, 6-12 months and 18-24 months.(1).The American College of Chest Physicians (ACCP) guidelines recommend a PET/CT or nonsurgical biopsy for solid nodules of at least 8 mm when the pretest probability of malignancy is low to moderate.(2) The pretest probability affects the interpretation of PET/ CT results: high risk patients are at risk of false negative results and low risk patients are at risk of false positive results.(3) If there is a high pretest probability of cancer, a negative PET/CT does not reliably rule out cancer and either continued surveillance for at least 2 years or tissue sampling is advised.(2,5) The ACCP states that the optimal interval for surveillance CT's for solid nodules > 8 mm is not determined, but standard practice is 3-6 months, 9-12 months and 18-24 months. They suggest surveillance with CT if the clinical probability of cancer is very low, the clinical probability of malignancy is low and a PET CT is negative, a PET CT is negative and a needle biopsy is non-diagnostic, or an informed patient prefers a non-aggressive approach. If a solid nodule shows clear growth on serial CT's, a non-surgical biopsy or surgical resection is recommended unless there are specific contraindications.(2) A surgical diagnosis is recommended if there is a high clinical probability of lung cancer, the nodule is intensely hypermetabolic on PET/CT, a non-surgical biopsy is suspicious for cancer or a patient prefers a definitive diagnosis.(2)

Multiple solid nodules < 6 mm are usually benign, representing granulomas or intrapulmonary lymph nodes. A 12 month follow up CT may be considered in high risk patients. If there is clinical evidence of infection or the patient is immunocompromised, infection should be considered. A short term follow CT may be appropriate. Multiple solid nodules with at least one nodule greater than or equal to 6 mm can be followed with CT's at 3-6 months and 18-24 months. Management should be based on the largest/

most suspicious nodule. Most metastases will grow over 3 months. The risk of cancer increases as the number of nodules increases from 1 to 4 but decreases if the number is greater than 4.

Subsolid nodules (SSN) include pure ground glass nodules (GGN) and part-solid nodules (PSN). SSN are more likely to be malignant than solid nodules but have a better prognosis than lung cancers which present as solid nodules.(3) Many have slow growth rates and may remain stable for years. Pure GGN < 6 mm do not require routine follow up. However, this should not preclude the option of follow up CT's at 2 and 4 years in high risk patients. GGN greater than or equal to 6 mm can be followed at 6-12 months and then every two years until 5 years. The Fleischner Society states that these guidelines are not intended to preclude either shorter or longer term follow up in individual patients when deemed clinically appropriate. The ACCP states there is controversy regarding how long to follow part solid or ground glass nodules and that follow up over several years may be appropriate.

Solitary PSN < 6 mm do not require routine follow up. A follow up CT may be done at 2 and 4 years. For PSN greater than or equal to 6 mm with a solid component < 6 mm, a follow up CT may be done at 3-6 months and then annually for a minimum of 5 years. The 5 year period is somewhat arbitrary but considered reasonable if the nodule is unequivocally stable during that time period. If the solid component is at least 6 mm, follow up at 3-6 months should be done. A persistent PSN with a solid component of at least 6 mm or a growing solid component is highly suspicious. If the nodule has suspicious morphology, if the solid component is growing or > 8 mm, PET/CT or biopsy should be considered.(1,3) Multiple PSN< 6 mm are often infectious. A repeat CT can be done at 3-6 months, then at 2 and 4 years. If at least one of the nodules is greater than or equal to 6 mm, a repeat CT can be done at 3-6 months, and management should be based on the most suspicious nodule.

Pulmonary cystic lesions may represent a cyst-related primary lung malignancy. There are no uniform surveillance criteria for these lesions, but some authors recommend a CT at 3-6 months to exclude rapid growth and then follow up CT's according to the SSN nodule guidelines.(6)

NCCN guidelines for the management of incidental pulmonary nodules are consistent with the Fleischner guidelines.(7) For pulmonary nodules detected on lung cancer screening CT's, adherence to the American College of Radiology (ACR) Lung-RADS guidelines is recommended.(1,4,8,9) The British Thoracic Society and ACCP guidelines do not distinguish the management of screening-detected nodules from nodules detected incidentally.(2,3)

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3. Callister ME, Baldwin DR, Akram AR, et al. British Thoracic Society guidelines for the investigation and management of pulmonary nodules. *Thorax*. 2015 Aug;70 Suppl 2:ii1-ii54.
4. Martin MD, Henry TS, Berry MF, et al. ACR Appropriateness Criteria Incidentally Detected Indeterminate Pulmonary Nodule. Expert Panel on Thoracic Imaging. *J Am Coll Radiol*. 2023 Nov;20(11S):S455-S470.
5. Maiga AW, Pinkerman R, Lambright ES, et al. Assessment of FDG F18-Labeled PET for Diagnosis of High-Risk Lung Nodules. *JAMA Surgery*. 2018 Apr 1;153(2): 137-142.

6. Mets OM, Schaefer-Prokip CM, de Jong PA. Cyst-related primary lung malignancies: an important and relatively unknown imaging appearance of (early) lung cancer. Eur Respir Rev. 2018 Dec 19;27(150):180079.
7. NCCN Guidelines Version 6.2024. Non-Small Cell Lung Cancer. Incidental finding of nodule suspicious for lung cancer. *need correct format of reference.
8. NCCN Guidelines Version 2.2024. Lung Cancer Screening. Lung nodule(s) on LDCT.*need correct format of reference.
9. Christensen J, Prosper AE, Wu CC, et al. ACR Lung-RADS v2022: Assessment Categories and Management Recommendations. J Am Coll Radiol. 2024 Mar;21(3): 473-488.