

Solitary Pulmonary Nodule

Common causes of solitary pulmonary nodules

BENIGN CAUSES	MALIGNANT CAUSES
Granulomatous infections Tuberculosis Coccidioidomycosis Other infections Pneumonitis Echinococcus cyst Ascariasis Dirofilaria immitis Pneumocystis carinii Atypical mycobacterial infection Benign tumors Hamartoma Lipoma Fibroma Noninfectious granuloma Sarcoidosis Wegener's granulomatosis Bronchiolitis obliterans with organizing pneumonia Congenital Pulmonary arteriovenous malformation Bronchogenic cyst Miscellaneous Rheumatoid nodule Amyloidoma Pulmonary infarction	Bronchogenic carcinoma Adenocarcinoma Large cell lung cancer Pulmonary metastasis Head and neck tumors Breast cancer Renal cell carcinoma Colon cancer Sarcomas Pulmonary carcinoid tumors

MODIFIED FROM STOLLER JK, AHMAD M, RICE TW. SOLITARY PULMONARY NODULE. CLEVELAND CLIN J MED. 1988; 55:68-74.

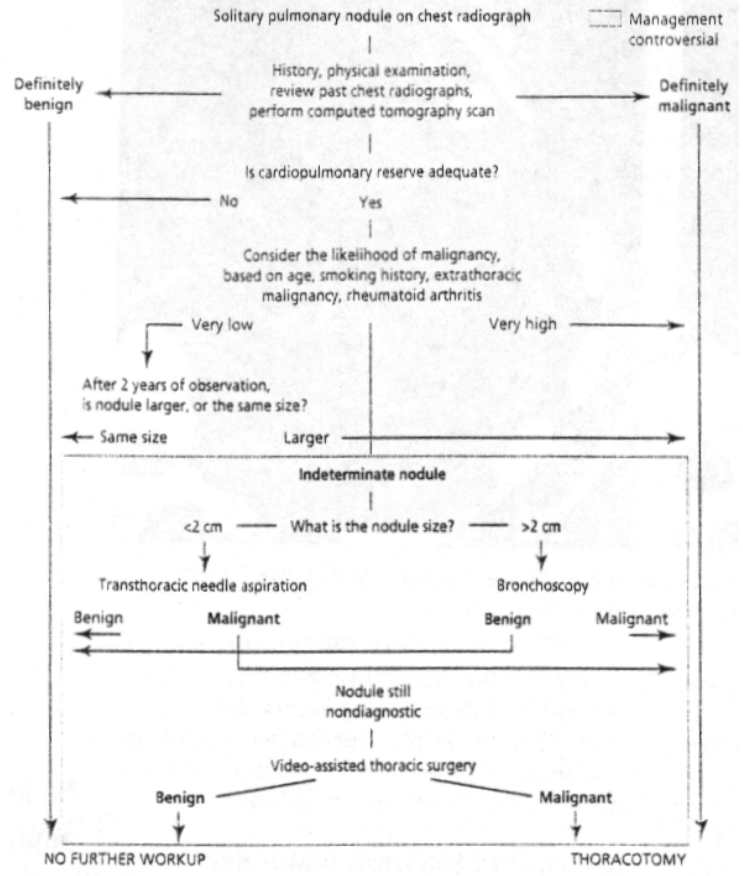
Pretest probability

- <0.12 – wait and see approach
- 0.12-0.69 – CT + PET scan cost-effective
- 0.69-0.90 – CT followed by biopsy or surgery
- >0.90 – Surgical strategy

Solitary pulmonary nodule mimics

Nipple shadows	Pseudotumor
Soft tissue tumors, eg, neurofibroma	Round atelectasis
Bony shadow, eg, old healed rib fracture	Electrocardiogram leads
Pleural plaque	Buttons

Algorithm for the management of SPN



Differentiating benign from malignant solitary pulmonary nodules

FEATURE	BENIGN	MALIGNANT
Age	< 35	> 50
Smoking	Nonsmokers	Smokers
Previous history of malignancy	No	Yes
Size of nodule	< 2 cm	> 2 cm
Calcification	Bull's eye, diffuse, laminated, or popcorn pattern	None
Doubling time	< 20 or > 400 days	20 to 400 days
Radiological stability over 2 years	More likely	Less likely
Spiculated edges	Less likely	More likely
Margins	Smooth	Irregular or lobulated
Air bronchogram sign	Less likely	More likely
Pleural tail sign	Less likely	More likely
Satellite lesions	More likely	Less likely
Enhancement on CT after IV contrast	< 20 Hounsfield units	> 20 Hounsfield units
PET with fluorodeoxyglucose	No uptake	Increased uptake

Solitary Pulmonary Nodule

Incidence – 0.09% - 0.2% of CXR's; range from benign granulomas to lung CA

Definition – SPN (“coin lesion”) is a single spherical lesion less than 3cm diameter surrounded by lung parenchyma without atelectasis or adenopathy.

Incidence of **malignancy** ranges from 10-68%

Benign lesions – 80% are infectious granulomas, 10% hamartomas, 10% rarer disorders.

Risk factors – age, smoking hx, hemoptysis, nodule size, edge characteristics on CT, and prior hx of malignancy are the most reliable for predicting malignancy.

Imaging – CXR is the initial modality, characteristics may help stratify risk

“Corona Radiata” – fine linear strands extending outward from nodule; high probability of malignancy (88-94%)

Calcification within lesion – likely benign

Laminated or central pattern – granuloma

Popcorn pattern – hamartoma

Diffuse calcification – likely benign

Stippled or eccentric calcification – likely malignant

CT – better visualization, improved sensitivity for calcification

Risk stratification – start with H+P, risk factor assessment, CXR, and usually CT

Benign – stable on serial CXR for ≥ 2 years, or pt <35 years with no risk factors

Take serial radiographs q3months for 1 yr then q4-6months over second year

Malignant – high enough probability that thoracotomy without further diagnostic tests are indicated

Intermediate – 70-75% will be malignant, management options include newer imaging or tissue diagnosis (bronchoscopy, needle biopsy, thoracotomy).

Biopsy

Bronchoscopy – useful for lesions ≥ 2.0 cm. Diagnostic yield varies 20-80%, depends on proximity to bronchial tree

Ultrathin bronchoscopy – experimental, visualize up to 9th generation airways.

Transthoracic needle aspiration biopsy (TNAB) – diagnostic yield up to 95% for peripheral lesions. Positive pred value of 98%, Neg pred value of 97%.

If no specific benign diagnosis is obtained, need to consider followup with additional diagnostics vs. thoracotomy.

Thoracotomy – Operative mortality 3-7% for malignant nodules, $<1\%$ for benign nodules. Video assisted thoracotomy most successful for peripheral lesions and some central lesions in lower lobe; conversion to open thoracotomy in 24% cases.

New imaging

Contrast enhanced CT – characteristics of contrast uptake may help differentiate malignant lesions. (e.g. no malignant nodules had a SPN to aorta enhancement ratio of less than 6%).

Positron emission tomography – increased uptake of FDG by lung tumors; diagnostic yield of 89-100%. Cost effective when combined with CT (reduces pts going to surgery by about 15%).

Choice of strategy for intermediate nodule

PET scan preferred; for negative PET, follow up with serial CT scans.

Approach to patient with a SPN

Obtain old Chest xrays, get a CT scan for nodule unless it has been stable x 2 years

Consider further imaging with Contrast enhanced CT or PET scanning

If no specific benign diagnosis then stratify risk and consider strategy of observation, biopsy, or thoracotomy.