SOLITARY PULMONARY NODULE

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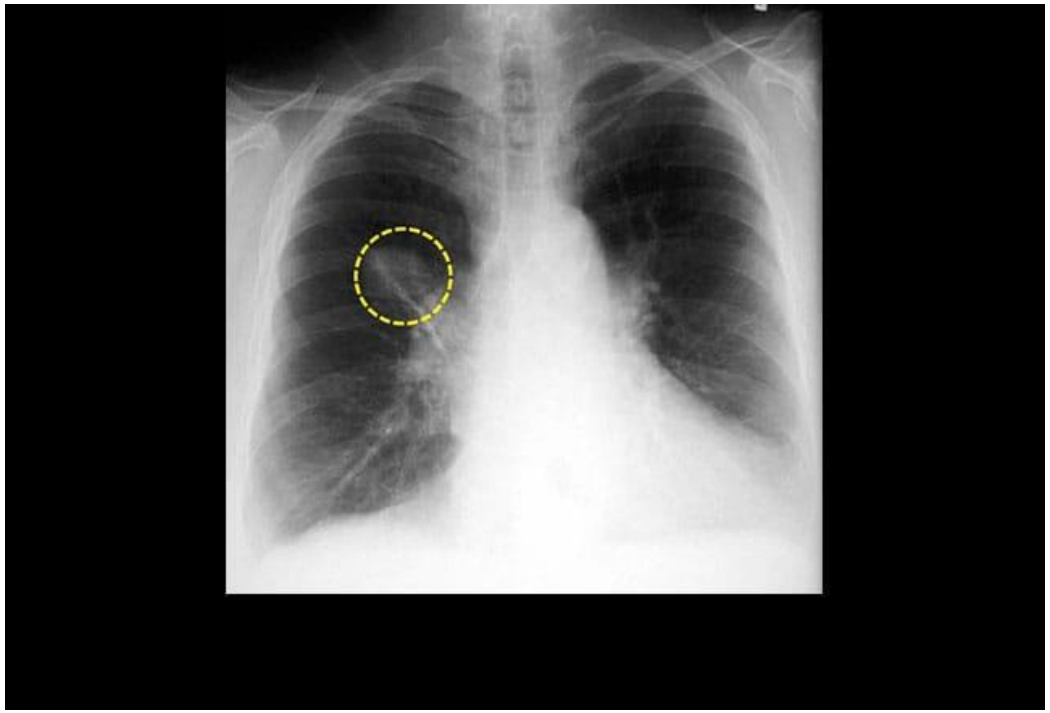
SOLITARY PULMONARY NODULE

- Solitary pulmonary nodule
- Definition:• One nodule (x-ray density) in the lung, completely surrounded by normal, aerated lung parenchyma
- Location: middle-to-lateral third of the lung.
- Size: 1-6 cm in diameter Usually found incidentally on CXR.•
- The question is: Is it benign or is it malignant?

APPROACH TO PULMONARY SOLITARY NODULE

- History
- Physical Examination
- Investigations



IS IT BENIGN OR IS IT MALIGNANT?

- The answer is: It depends on:
- Patient's risk factors (age, sex, medical history, family history, cigarette smoking, occupation)...Is the patient low risk or high risk?
- The nodule features

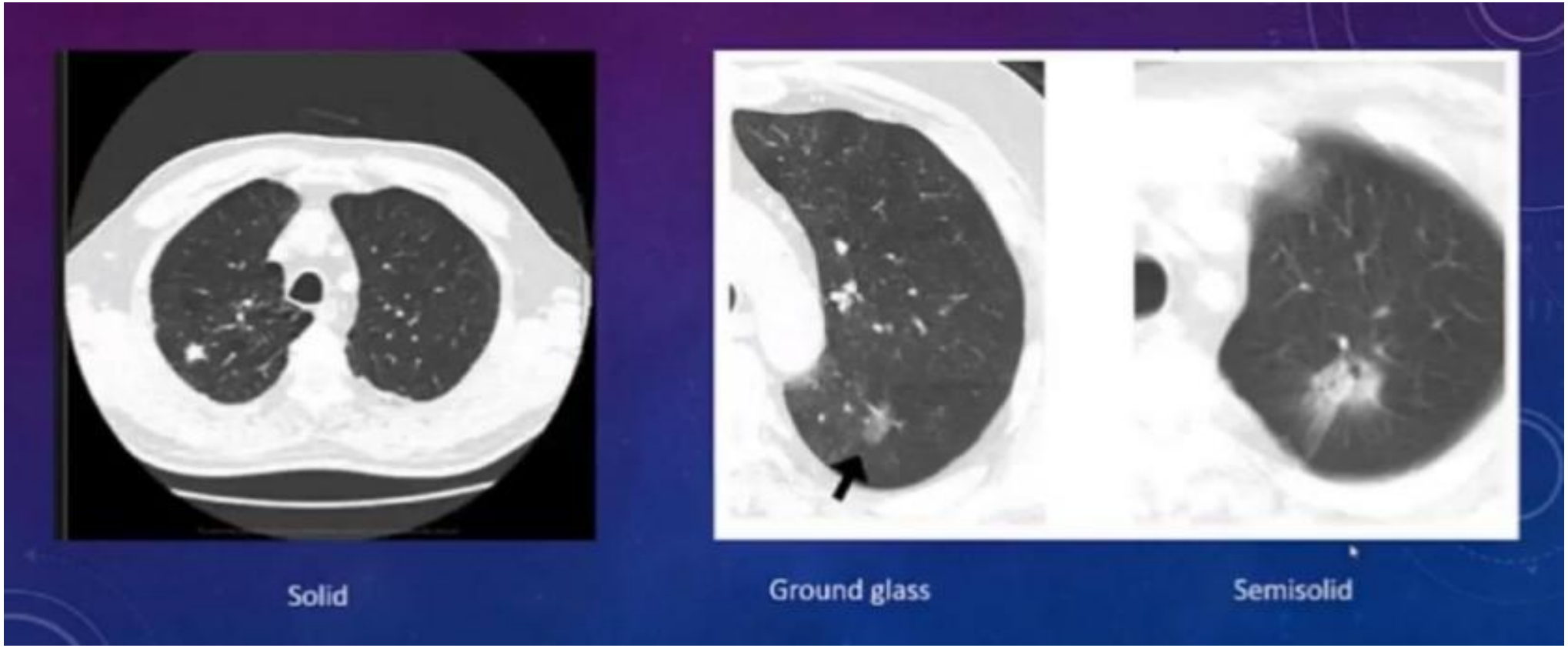
RISK FACTORS

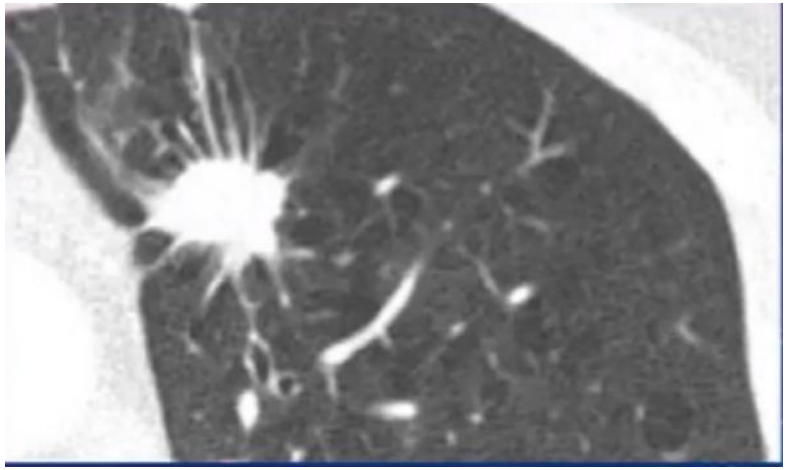
- Age
- Gender
- History of smoking
- History of lung infection
- Previous cancer diagnosis
- History of travel
- History of work
- The country (the likelihood ration differs from a country to another).

NODULE FEATURES

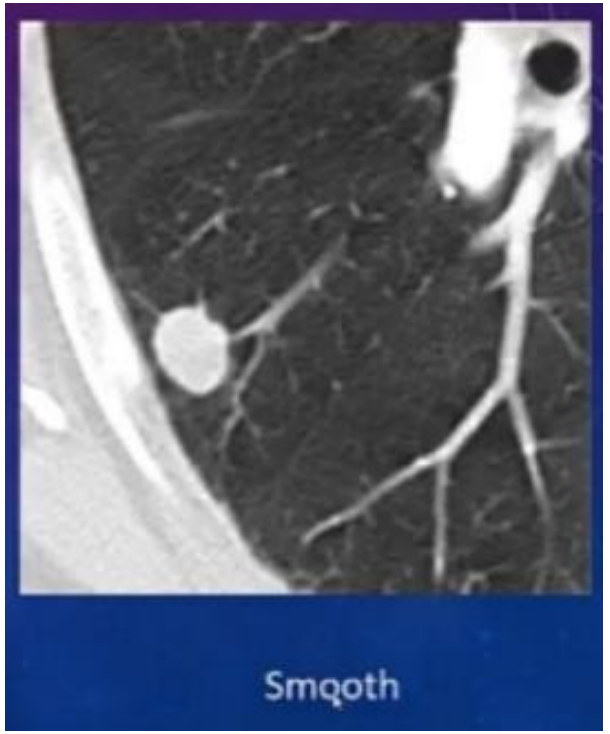
- 1) Size (The smaller _ the better)
- 2) border
  malignant _ irregular , lobulated
  benign _ smooth , discrete border
- 4) growth rate (Most malignant nodule have volume doubling time (VDT) between 20 and 400 days)
- 5) location (malignant lesions are more likely to be in the upper lobes)
- 6) density
- 7) cavitation (thin walled cavitating nodules are better)

DENSITY





Lobulated

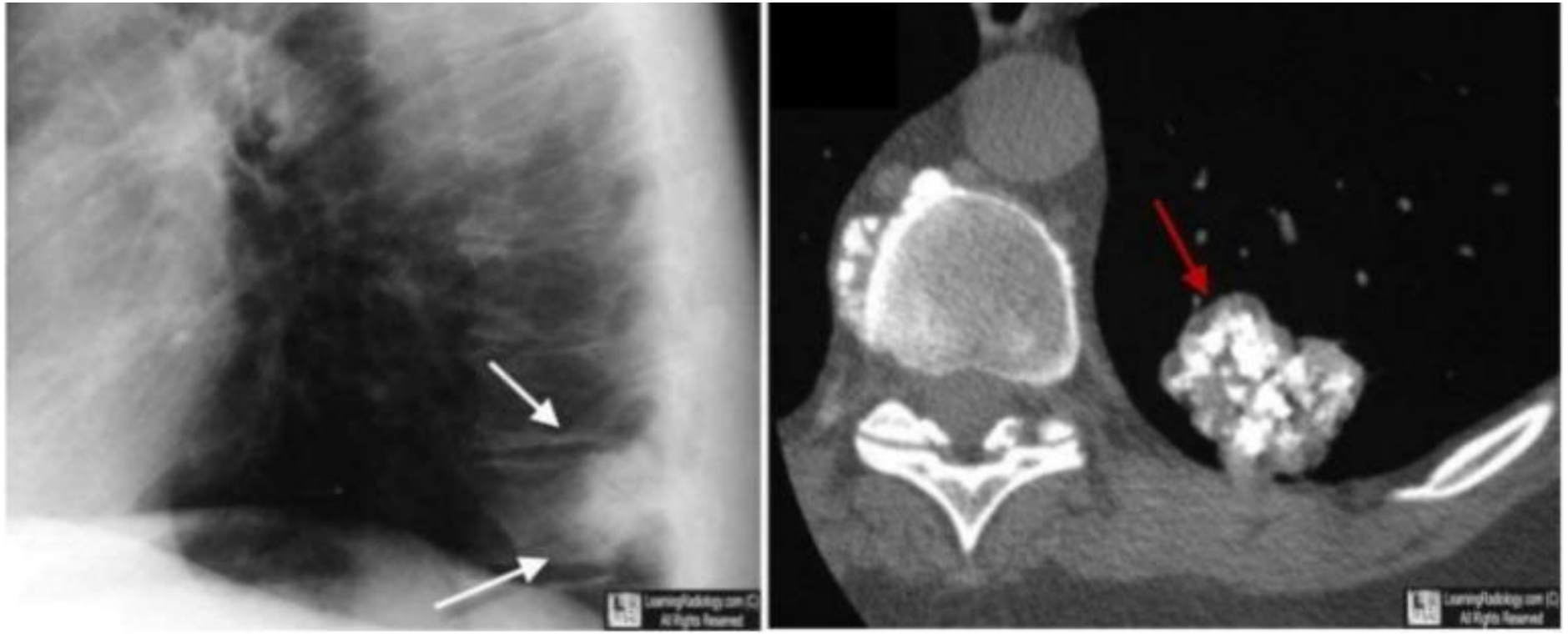


Smqoth

BORDER

CALCIFICATION

- 8) Calcification (depending on the pattern): When you find asymmetric calcification -> it's usually benign
- Mnemonic: Calcification-> Calm down.
- if you see "popcorn calcification" -> almost always a hamartoma (benign)
- if you see "laminated calcification that looks like a target or a bull's eye" -> granuloma (benign)
- if you see a dense central nidus of calcification -> benign.
- If you see multiple punctate foci of calcification -> benign



ASSESSING THE RISK OF MALIGNANCY:

Table 1. Risk factors for lung cancer and risk of malignancy in patients with pulmonary nodules.

Factors	Tumor risk		
	Low	Middle	High
Size of pulmonary nodules (mm, in diameter)	<8	8-20	>20
Age (years)	<45	45-60	>60
Tumor history	Without tumor history		With tumor history
Smoking history	Never	Smoking, <1 pack per day	Smoking, ≥1 pack per day
History of smoking cessation	Having quit smoking for ≥7 years	Having quit smoking for <7 years	Never quite smoking
Chronic obstructive pulmonary disease	No	Yes	
History of asbestos exposure	No		Yes
Nodule characteristics	Smooth	Lobulated	Burr-like

PHYSICAL EXAMINATION

- No specific physical finding and most of patients are asymptomatic..

** But we can notice :

- persistent coughing
- Hemoptysis
- Clubbing
- loss of weight

INVESTIGATION

- • CBC: Hb, ESR

Anemia or an elevated sedimentation rate may indicate an underlying neoplastic or infectious process•

- Liver enzymes and calcium elevated levels of liver enzymes, alkaline phosphatase, or serum calcium may indicate metastases from solitary bronchogenic carcinoma or from a non-pulmonary malignancy•
- Serology; for histoplasmosis & coccidioidomycosis•
- Tuberculin skin test

INVESTIGATION (CONT)

- Chest X-RAY
- CT SCAN Looking for:

Site and size

margin characteristics

Calcification pattern

opacities

Growth rate

- Try to obtain an old image (CXR or CT-SCAN)and compare it with the current one if this is not available
- high resolution CT
- Then : define the patient as low risk or high-risk (explained previously)
- Finally :for low risk patient :just follow up
- for high risk patient : other investigations & maybe surgery

MANAGEMENT

Management of a solitary pulmonary nodule		
Type	**Low risk patient**	**High risk patient**
Why?	Young (<35 years old)	Old (55-65)
	Non-smoker	Smoker for decades "pack year," occupation, family history
	<1 cm "<8 mm"	>1 cm ">8 mm"
	Asymmetrically Calcified solitary nodule. Not growing (compared to previous image)	• Non-calcified nodule, • Symmetric calcification • Symptoms (cough, dyspnea, hemoptysis) • Pneumonia, atelectasis, a growing lesion.
Diagnosis	Follow up with a CXR every 3 months. If after 2 years, it is NOT growing, it's benign.	FNA (CT-scan-guided). Navigational bronchoscopy Endobronchial ultrasound (EBUS) PET scan
Treatment	"Do nothing"	Surgery (wedge resection, or lobectomy),

POSITION EMISSION TOMOGRAPHY (PET)

- Malignant cells need more energy than normal cells and benign abnormalities because they are multiplying more quickly; therefore, they consume more sugar.
- PET involves a radiolabeled substance to measure this activity
- Malignant nodules absorb more of the substance than benign nodules and normal tissue and can be readily identified on the 3-dimensional, colored image.

POSITION EMISSION TOMOGRAPHY (PET) CONT

- PET scan is an accurate, noninvasive diagnostic test . They are routine if the nodule is big enough (>8mm) to make them useful.
- If the nodule is too small (BAC , Carcinoid or tumors < 1 cm …. Give false negative result), they don't take up enough of the radiolabeled glucose.

False + in cases of infection , inflammation,..

- PET-CT : can provide more anatomical details.

BIOPSY

- Different ways are used to collect biopsy samples from the airway or lung tissue where the SPN is located.

1).. Bronchoscopy: This procedure is used for SPNs that are situated closer to the walls of the airways. (central)

2).. If the lesion is not easily accessible on the airway wall or is smaller than 2 cm in diameter, a needle biopsy may be performed. This procedure is called a transbronchial needle aspiration (TBNA) biopsy.

BIOPSY (CONT)

- 3. Transthoracic needle aspiration (TTNA) _Most common complications : Pneumothorax
  and hemorrhage.
- 4) Video-assisted thoracoscopy (VATS) (surgical biopsy)

VIDEO ASSISTED THORACOSCOPY (VATS)

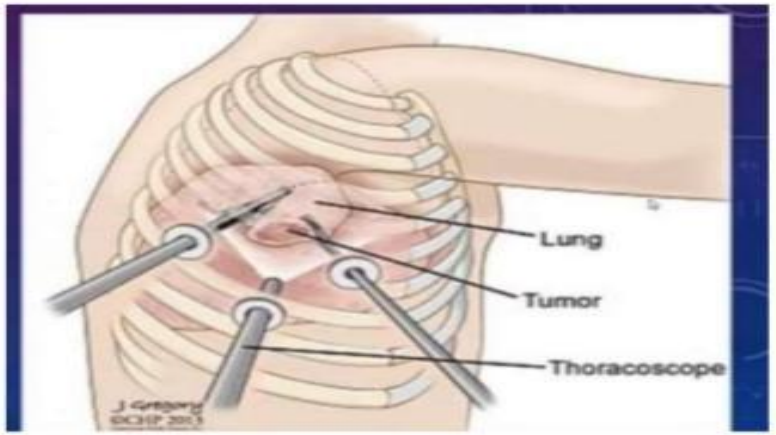
- This is an option that may be used to remove the nodule for both treatment and for confirming diagnosis.
- Does not require a full thoracotomy incision or spreading of the ribs.
- Removal of peripheral nodules with a wedge resection.
- If at the time of VATS the frozen section is positive for malignancy, an open thoracotomy can be performed for proper anatomic resection. .
- If a benign lesion is found, the procedure saves the patient from the invasiveness of a full thoracotomy and lobectomy

SURGERY

- If the nodule is found to be benign at frozen section, then only a wedge resection is required, and operative mortality is typically low.
- if the nodule is found to be malignant, then a lobectomy with systematic lymph node dissection is preferred. Lobectomy mortality has been reported to be 1–4% .
- Thoracotomy for resection of SPNs is usually limited to lesions with a high likelihood of malignancy when lobectomy and nodal resection are necessary for definitive lung cancer staging and treatment.

VATS

- Wedge Resection
  - Diagnosis rate 90-95%
  - Complication: 0.5%



- Lobectomy
  - Complication: 4%

- Conversion to thoracotomy is 12 %

OTHER NODULE MANAGEMENT GUIDELINES:

- **FLEISCHNER SOCIETY 2017**

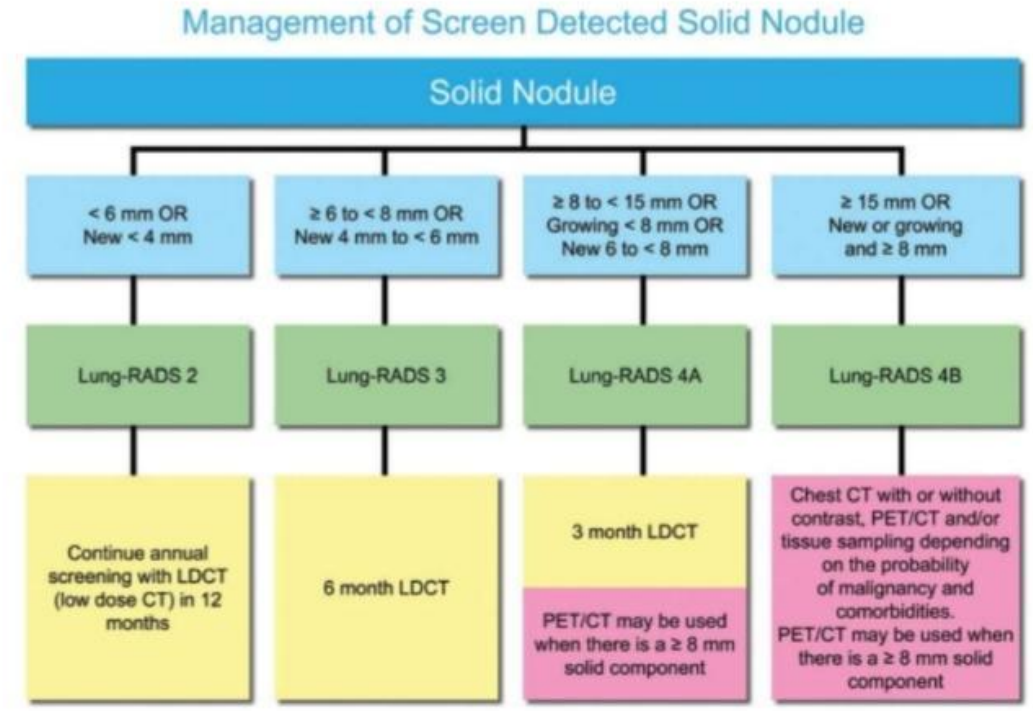
2 Minute Medicine® Solid Nodules 2minutemedicine.com			
	<6 mm (<100 mm^3)	**6-8 mm (100-250 mm^3)**	**>8 mm (>250 mm^3)**
Single			
Low Risk	No routine follow-up	CT at 6-12 months, then consider CT at 18-24 months	Consider CT at 3 months, PET/CT, or tissue sampling
High Risk	Optional CT at 12 months	CT at 6-12 months, then CT at 18-24 months	Consider CT at 3 months, PET/CT, or tissue sampling
Multiple			
Low Risk	No routine follow-up	CT at 3-6 months, then consider CT at 18-24 months	CT at 3-6 months, then consider CT at 18-24 months
High Risk	Optional CT at 12 months	CT at 3-6 months, then CT at 18-24 months	CT at 3-6 months, then CT at 18-24 months

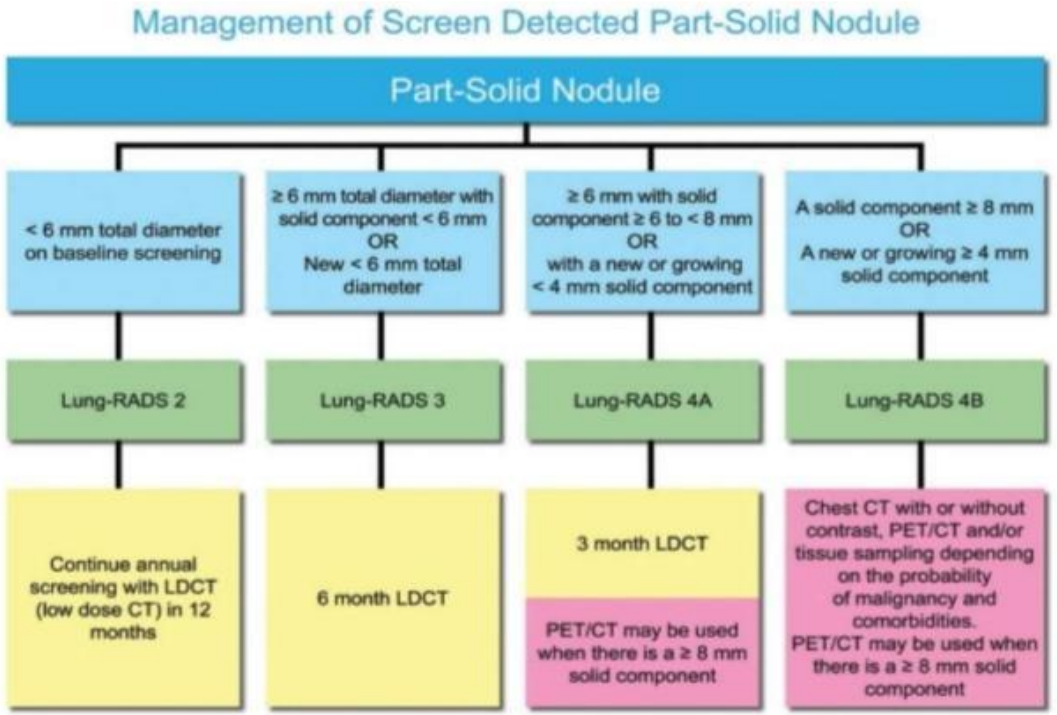
Table I. 2017 Fleischner Society Guidelines for Management of Incidentally Detected Solid Pulmonary Nodules in Adults.

2 Minute Medicine® Subsolid Nodules 2minutemedicine.com		
	<6 mm (<100 mm^3)	**≥6 mm (>100 mm^3)**
Single		
Ground Glass	No routine follow-up	CT at 6-12 months to confirm persistence, then CT every 2 years until 5 years
Part Solid	No routine follow-up	CT at 3-6 months to confirm persistence. If unchanged and solid component remains <6 mm, annual CT should be performed for 5 years.
Multiple		
Ground Glass or Part Solid	CT at 3-6 months. If stable, consider CT at 2 and 4 years.	CT at 3-6 months. Subsequent management based on the most suspicious nodule(s).

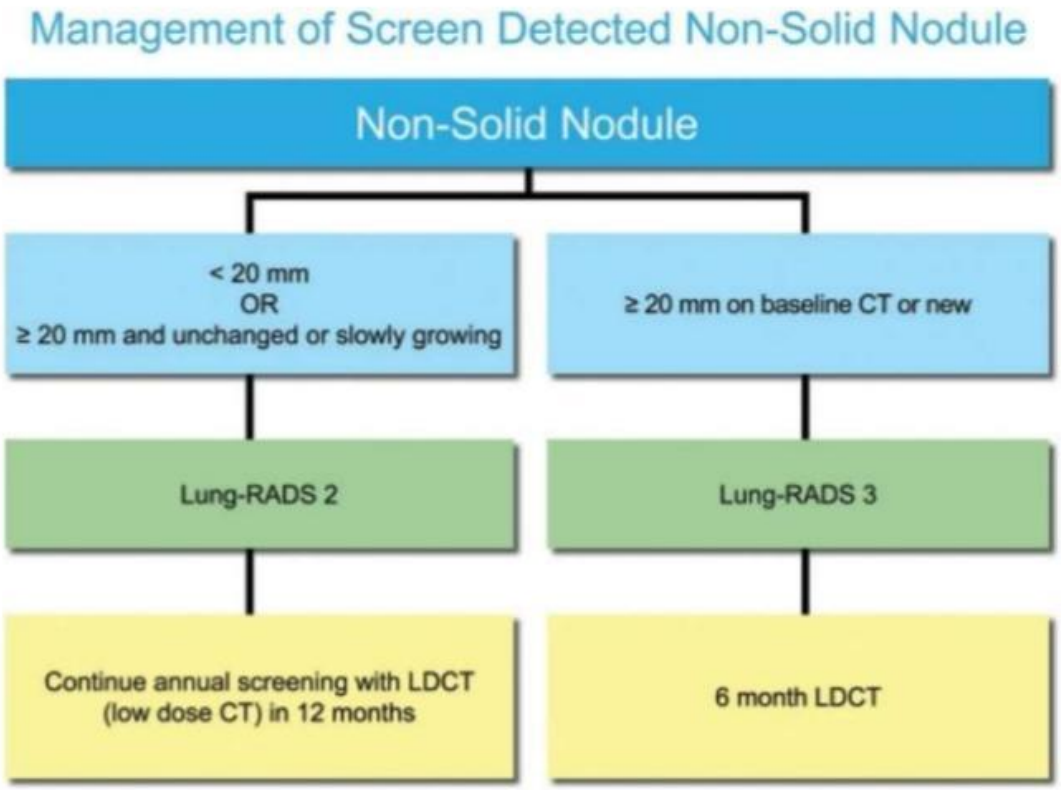
Table II. 2017 Fleischner Society Guidelines for Management of Incidentally Detected Subsolid Pulmonary Nodules in Adults.

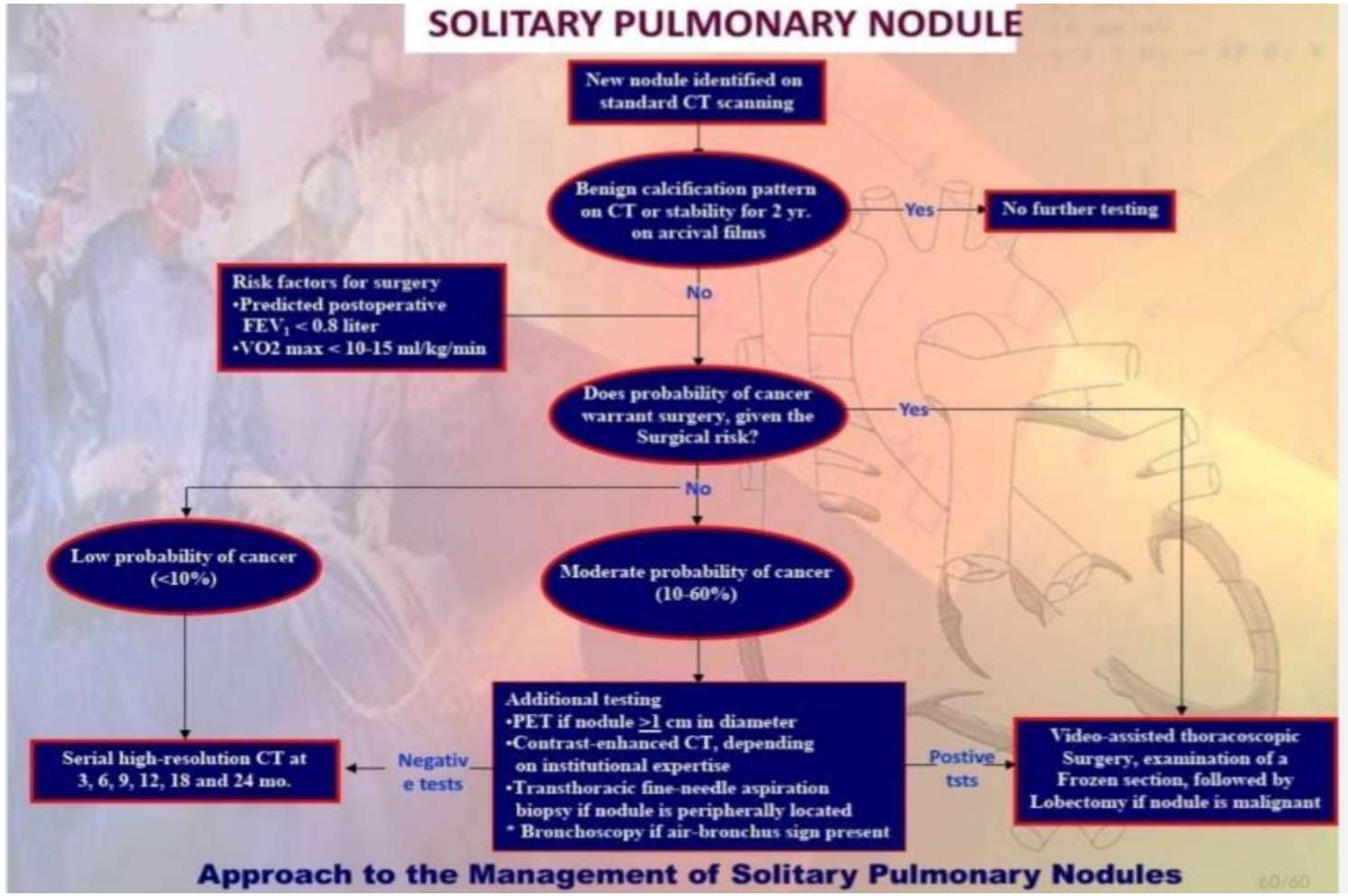
ACR LUNG RADS





ACR LUNG RADS




SOLITARY PULMONARY NODULE
New nodule identified on standard CT scanning
Benign calcification pattern on CT or stability for 2 yr. on arcival films
Yes
No further testing
No
Risk factors for surgery
•Predicted postoperative FEV1 < 0.8 liter
•VO2 max < 10-15 ml/kg/min
Does probability of cancer warrant surgery, given the Surgical risk?
Yes
No
Low probability of cancer (<10%)
Moderate probability of cancer (10-60%)
Additional testing
•PET if nodule ≥1 cm in diameter
•Contrast-enhanced CT, depending on institutional expertise
•Transthoracic fine-needle aspiration biopsy if nodule is peripherally located
* Bronchoscopy if air-bronchus sign present
Negative tests
Postive tsts
Serial high-resolution CT at 3, 6, 9, 12, 18 and 24 mo.
Video-assisted thoracoscopic Surgery, examination of a Frozen section, followed by Lobectomy if nodule is malignant
Approach to the Management of Solitary Pulmonary Nodules

THANK YOU