

肺結節與腫瘤判讀

高醫附院 胸腔內科

莊政皓

20260801

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Outline

- **Glossary of terminology in lung nodules**
- **Imaging technique and size measurement**
- **Differentiation of malignant/benign lesions**
- **Lung-RAD system**

Glossary of terminology in lung nodules

Fleischner Society: Glossary of Terms for Thoracic Imaging

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Conflicts of interest are listed at the end of this article.

See also the editorial by Adusumilli in the March 2024 issue.

See also the editorial by Hariri et al in the March 2024 issue.

See also the editorial by Bhalla in the February 2024 issue.

See also the editorial by Powell in the February 2024 issue.

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Radiology. 2024 Feb;310(2):e232558

The aim of the present glossary is to establish standardization of terminology for thoracic radiology and to facilitate communications between radiologists and other clinicians

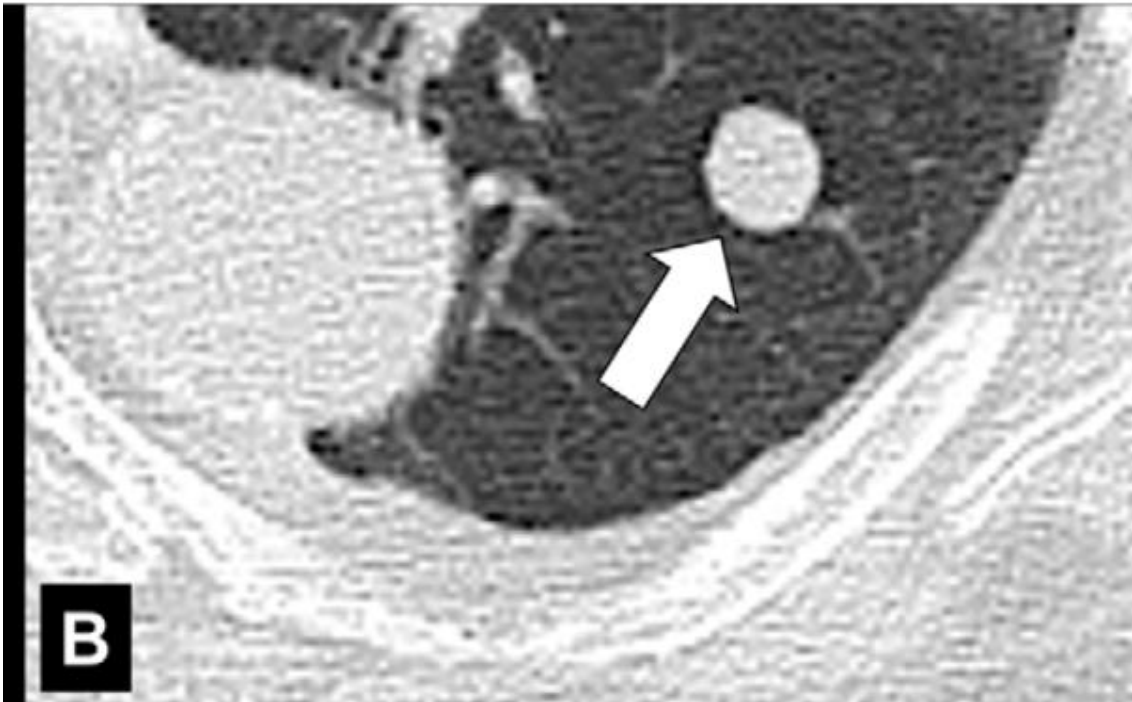
Nodule

- ❑ A nodule is a circumscribed, typically round opacity, less than or equal to **30 mm** in average diameter.
- ❑ A rounded lesion larger than 30 mm is referred to as a mass
- ❑ A rounded lesion less than **6 mm** in diameter should be called micronodule (previously defined as less than 3 mm), a term which serves to distinguish it from larger potentially actionable nodules, consistent with current management guidelines
- ❑ "Tumor" is a more neutral term, regardless of the size
- ❑ The terminology described below is intended to standardize the description and reporting of nodules, while acknowledging that nodules represent a **morphologic spectrum**, encompassing both benign and malignant features.

Shape and margin for Nodule

The margin of a nodule can be **well-defined** or **ill-defined**, depending on the **appearance of the interface with the surrounding lung**.

well-defined margin

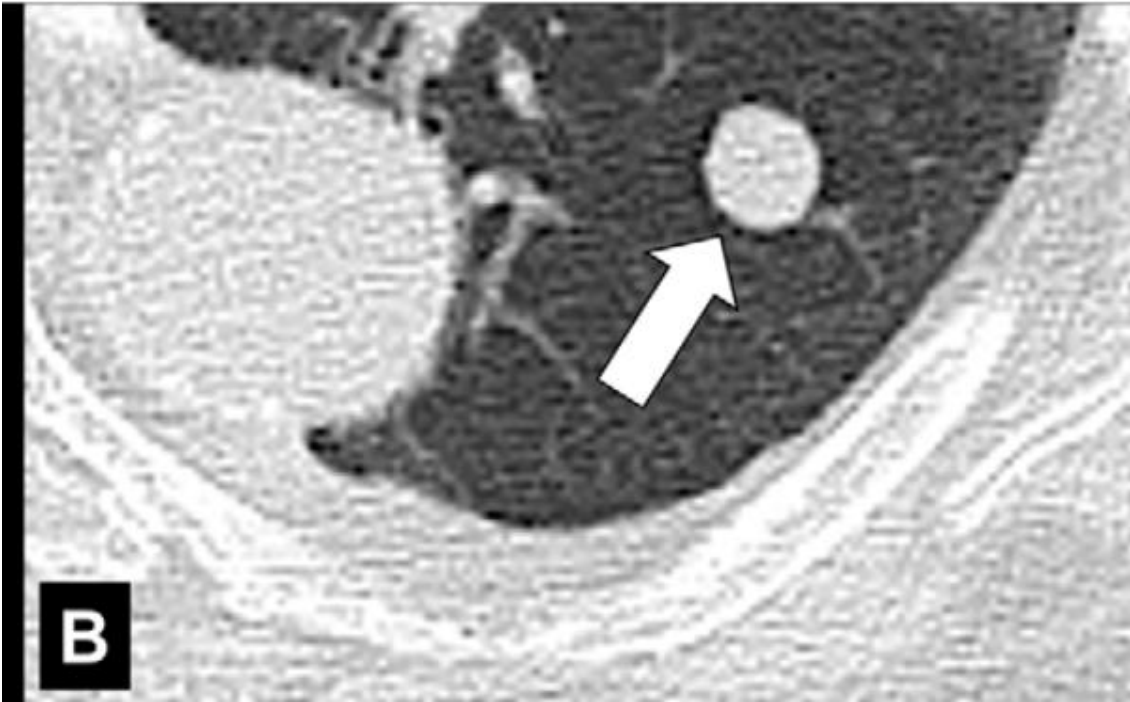


ill-defined margin

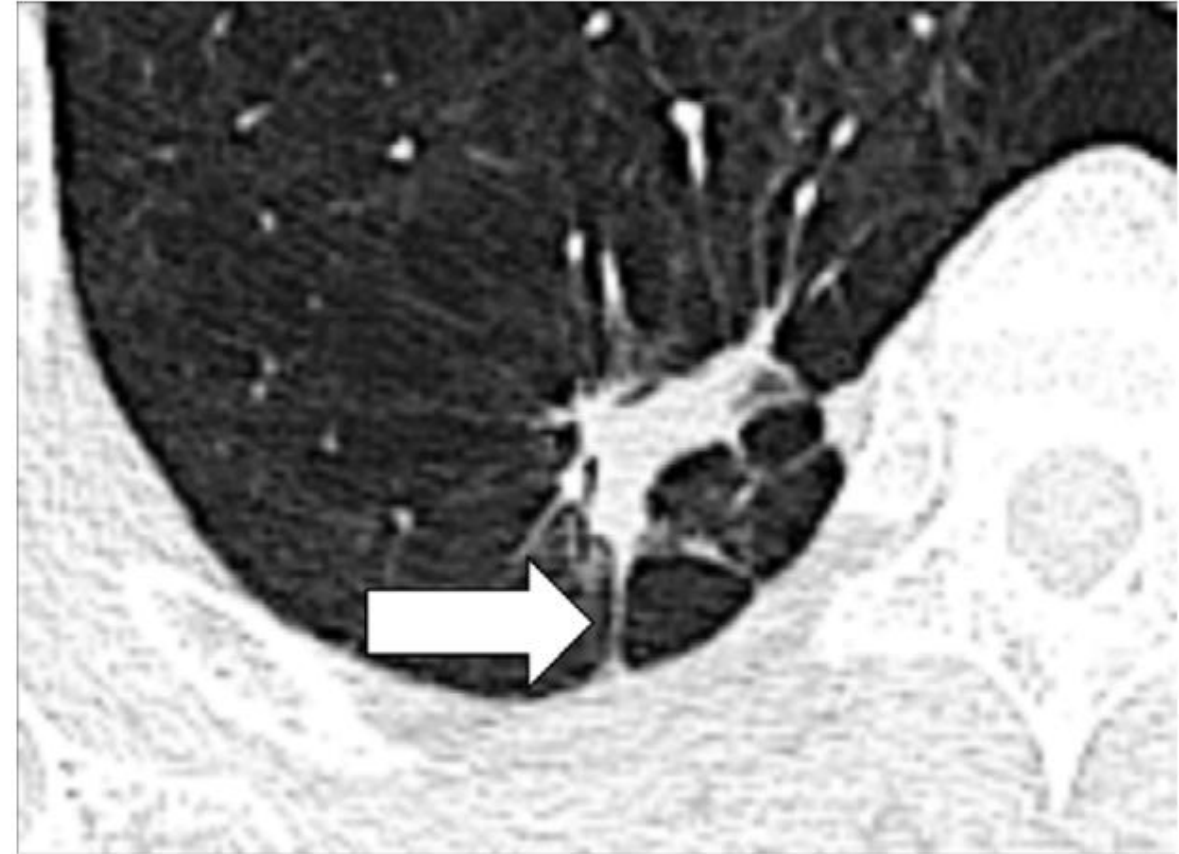


Shape and margin for Nodule

A **smooth** nodule border is even and free of substantial protrusions or indentations, as opposed to an **irregular** nodule border.



Smooth and regular nodule

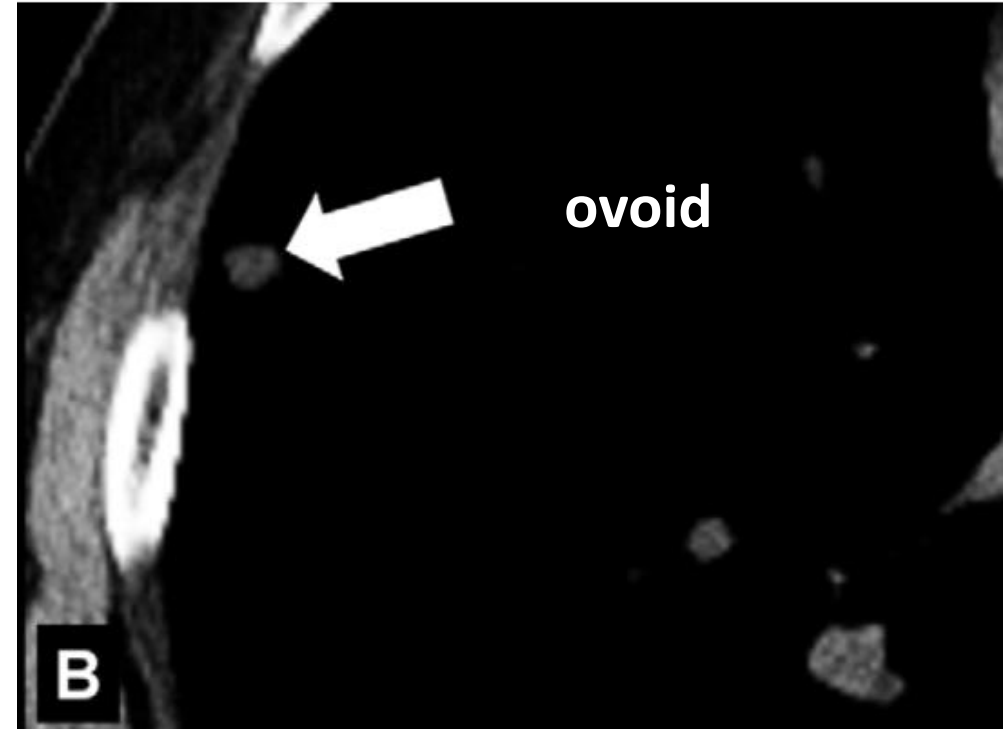
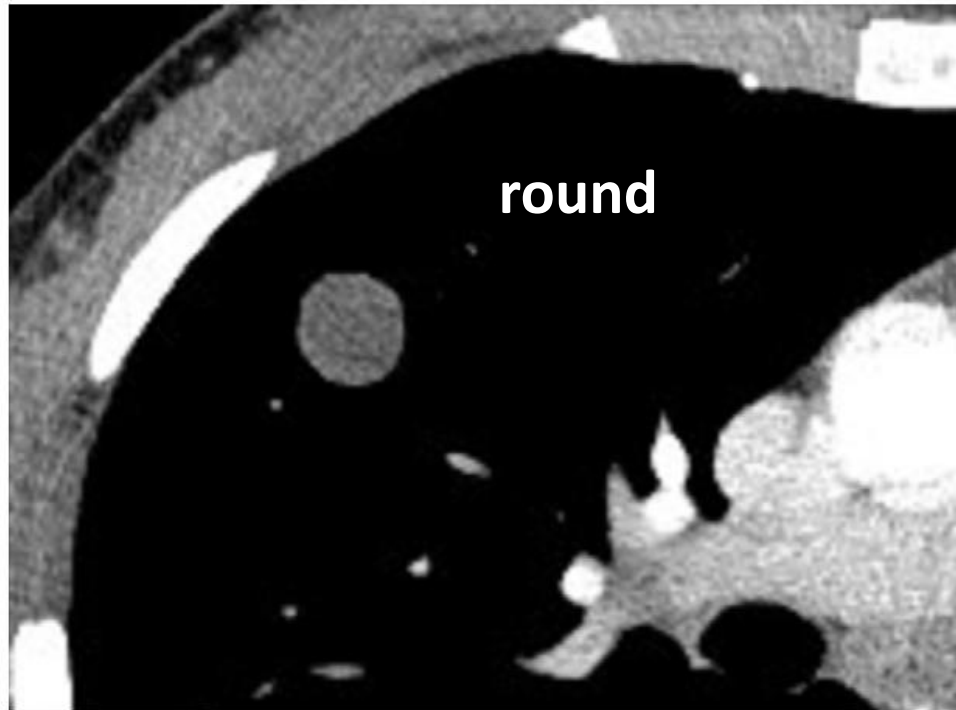


Irregular nodule with spiculations and pleural tags

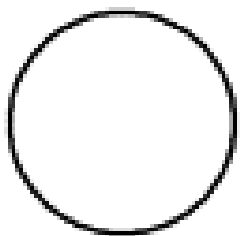
Shape and margin for Nodule

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Nodules can be described as round, ovoid, or polygonal in shape, and aspherical, flat, or elongated in configuration, based on their appearance in various imaging planes.



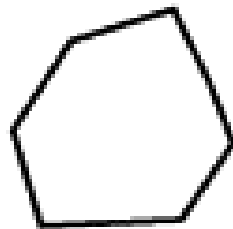
Round/Oval



Lobulated



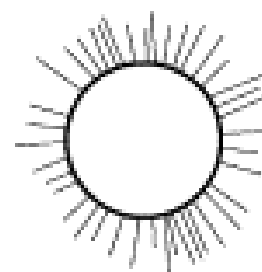
Polygonal



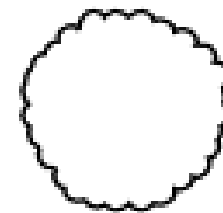
Tentacular



Spiculated



Ragged



Irregular

Exceptions to the other shapes

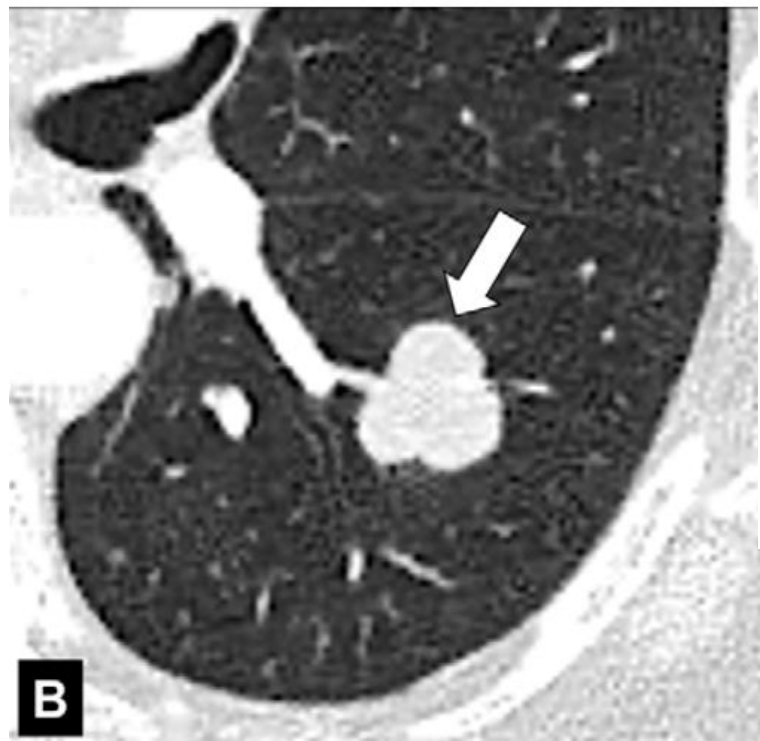
Shape and margin for Nodule

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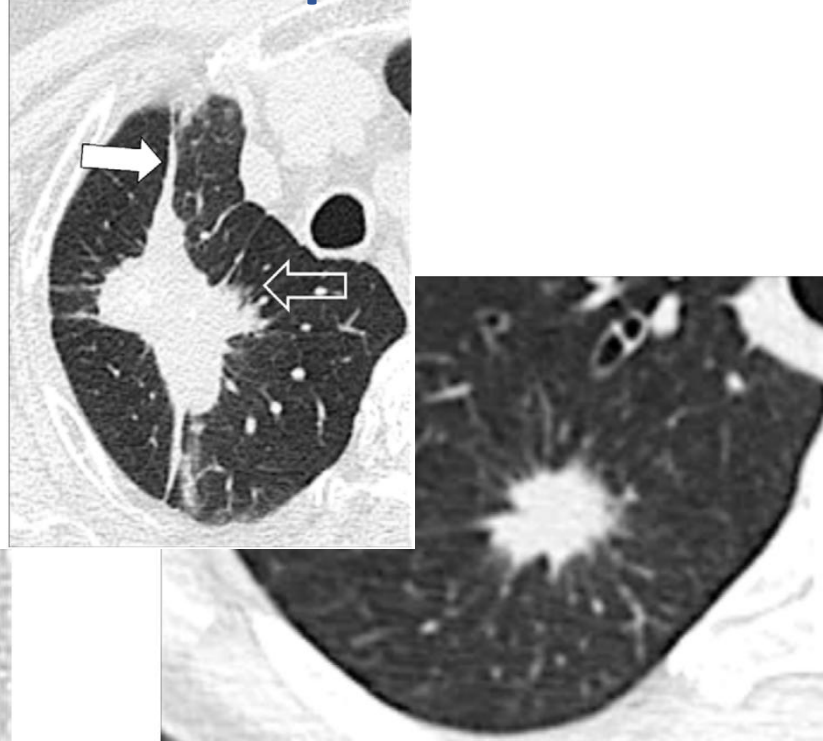
Irregular borders can be

- ❑ lobulated, with lobule-like protrusions, lobulation
- ❑ Spiculated with multiple radiating small sharp projections, spiculation
- ❑ Linear components extending from the nodule to a pleural surface are called pleural tags
- ❑ Combinations of the above shapes and margins may occur

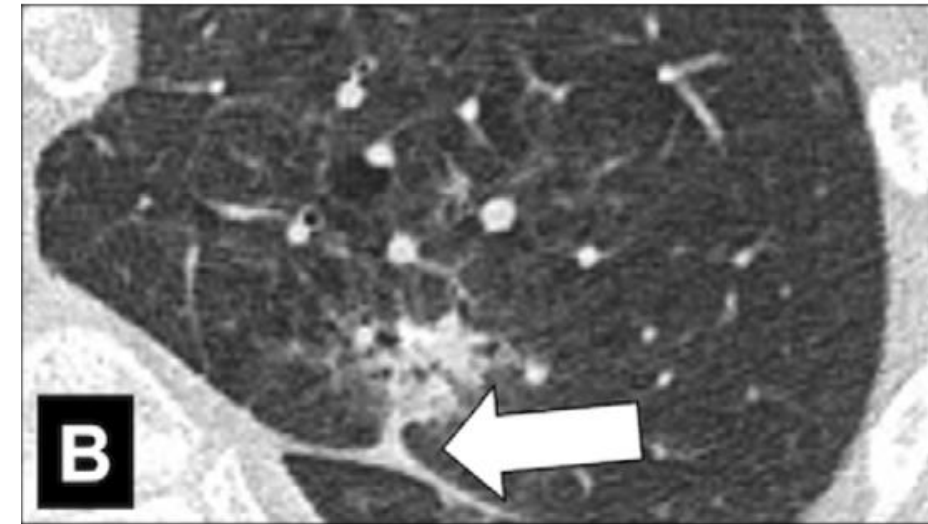
Lobulated nodule



Spiculated



Pleural tags

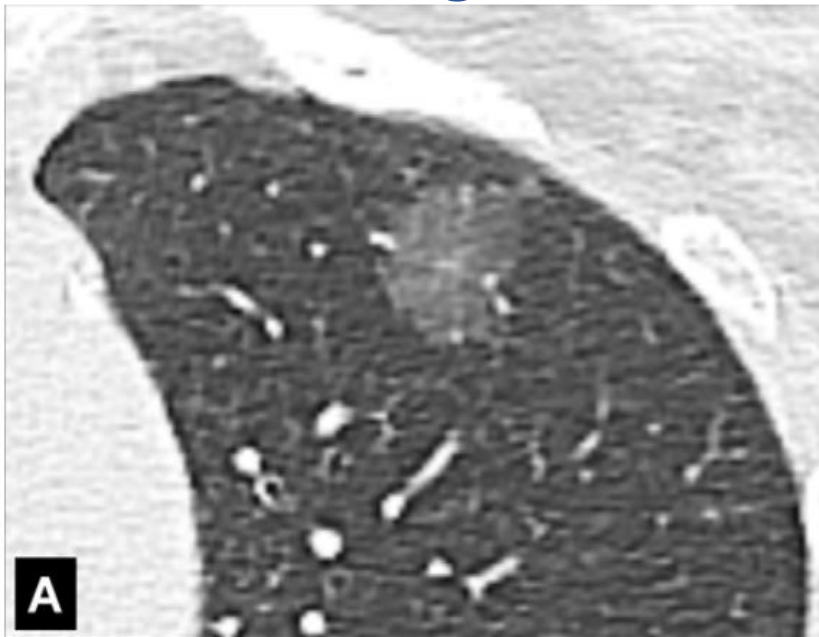


Attenuation and structure for Nodule

Based on attenuation,

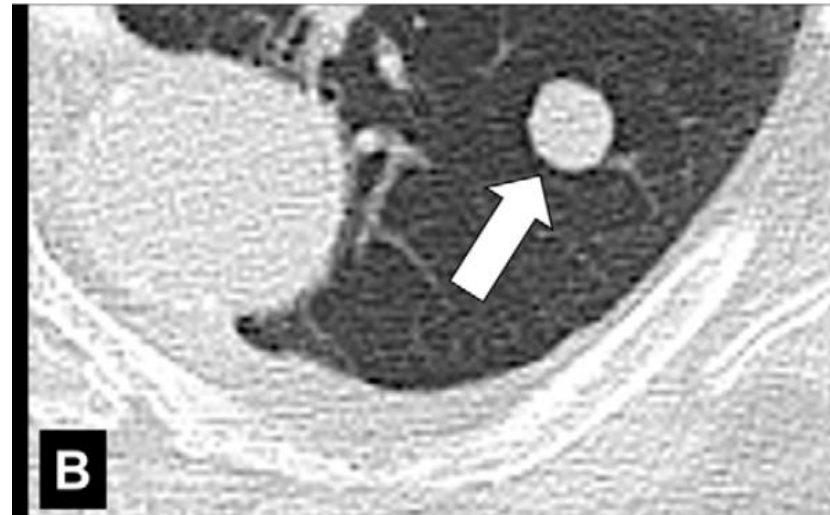
- ❑ Nodules with pure ground-glass attenuation are referred to as ground-glass nodules
 - ✓ characterised by areas of hazy increased attenuation of the lung with **preservation of bronchial and vascular margins**
- ❑ Nodules with pure soft tissue attenuation are referred to as solid nodules
- ❑ Nodules with both ground-glass and soft tissue attenuation components are referred to as part-solid nodules; Consolidation-to-Tumor Ratio

Ground-glass



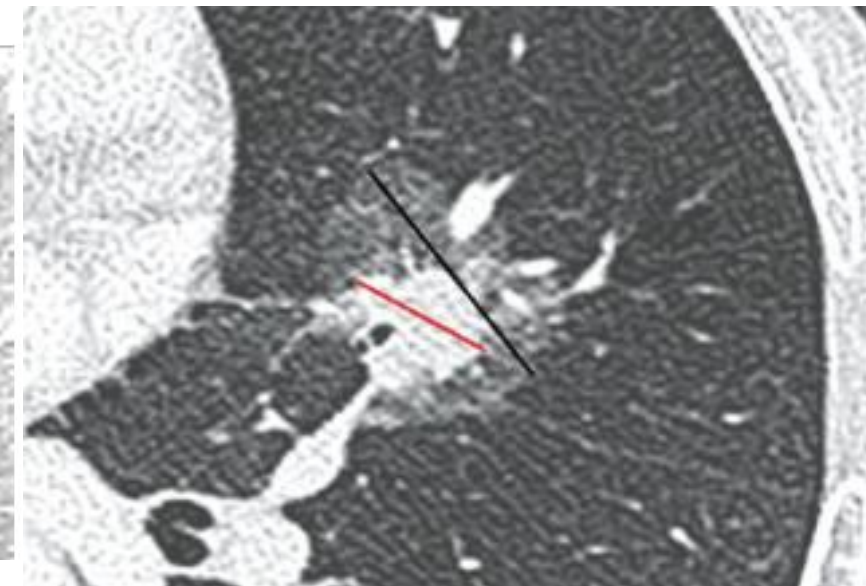
CTR=0

Solid



CTR =1

Part-solid



$0 < \text{CTR} < 1$

Solitary pulmonary nodule: Density

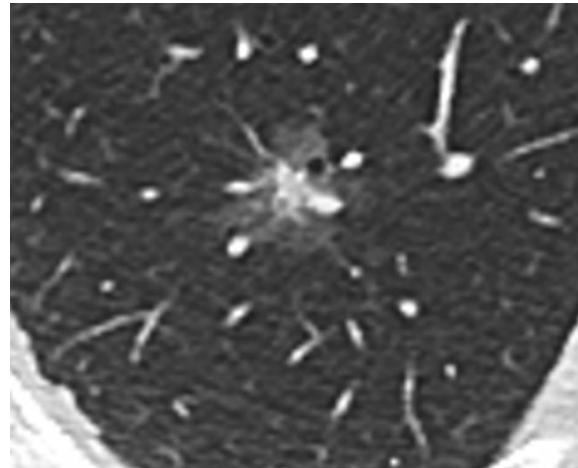
- Solid: the density of the nodule **obscures the underlying parenchyma**
- Pure ground glass nodule (GGO): density higher than that of normal lung parenchyma, but the **normal lung architecture is preserved** with normal bronchial and vascular margins
- Part-solid nodules (halo-sign) : ground-glass component surrounding solid nodules
- Reverse halo sign: ground glass surrounded by a ring of consolidation



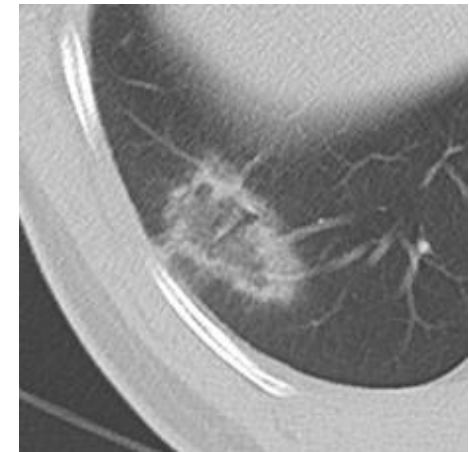
Solid



Pure GGO



Part-solid (halo sign)



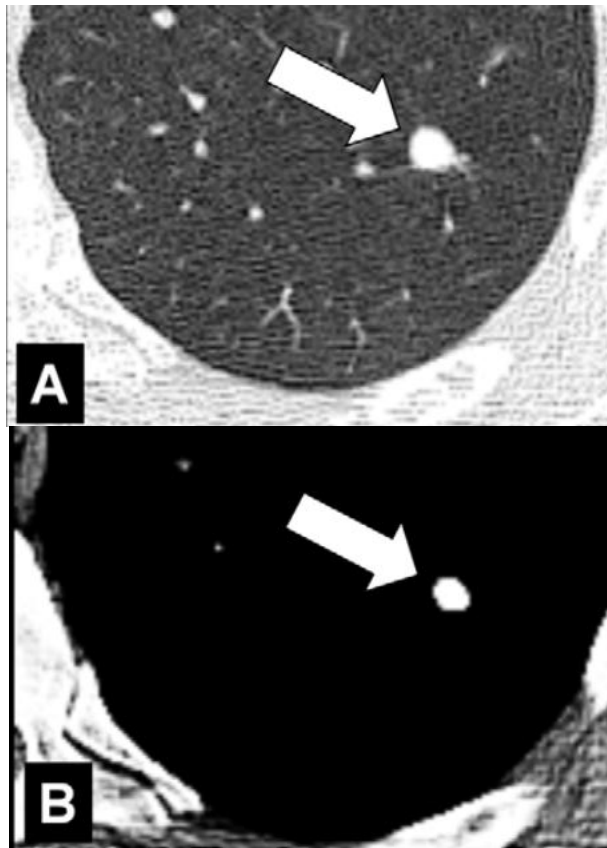
Reverse halo

Attenuation and structure for Nodule

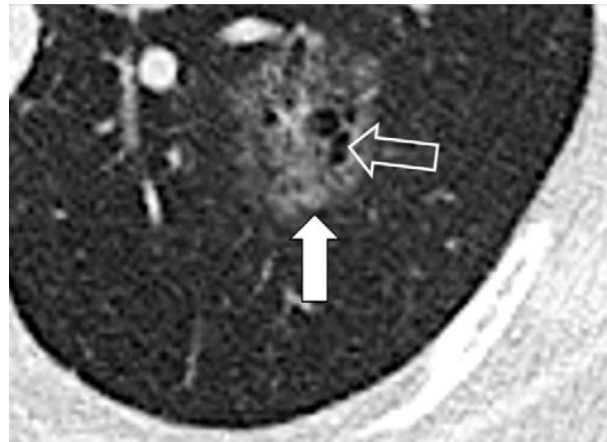
Based on structure, nodules are either “**simple**” or “**complex**”

- ❑ Simple nodules: single structural component (soft tissue, ground-glass, calcium, fat)
- ❑ Complex nodules, two or more components (soft tissue, ground-glass, calcium, fat, air)

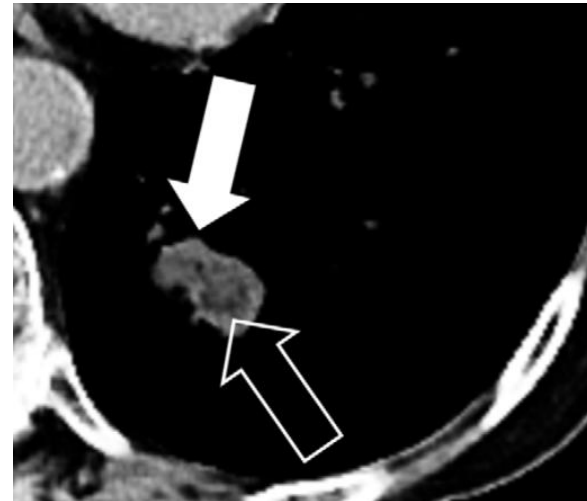
Simple calcified nodule



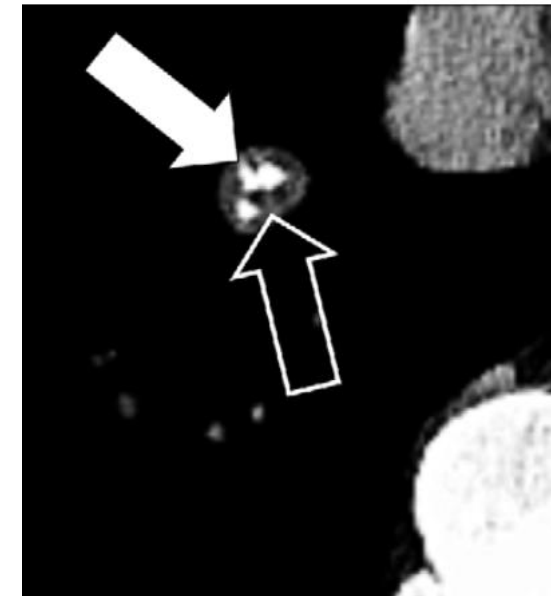
Complex nodule with cystic and ground-glass



Complex nodule with fat and soft tissue



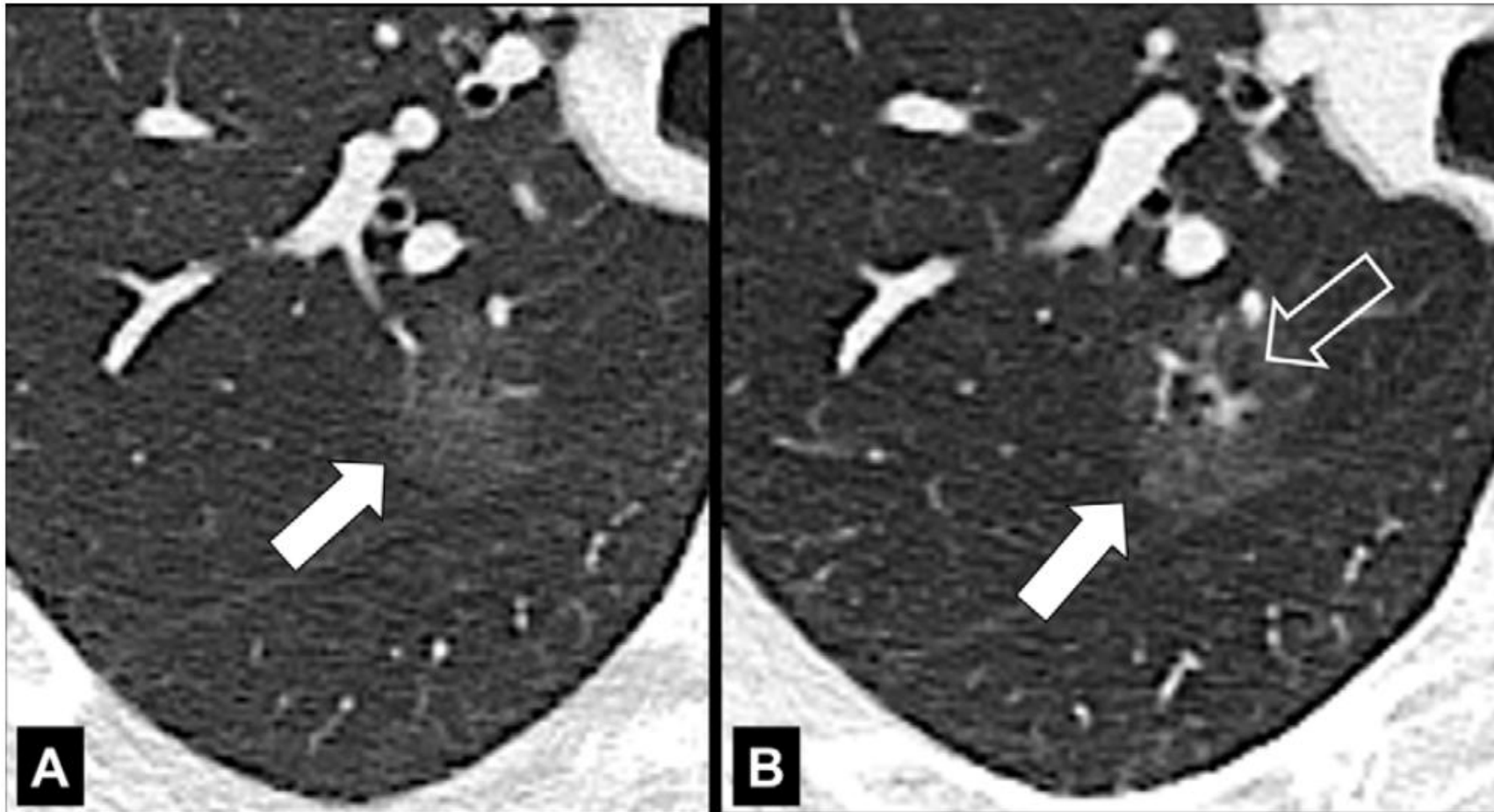
Complex nodule with a calcified and soft tissue



Attenuation and structure for Nodule

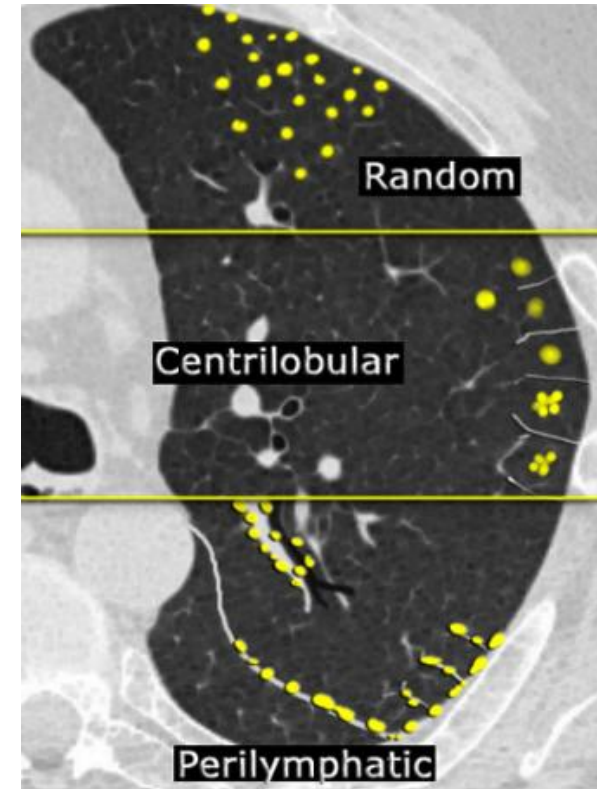
- ❑ Of note, simple nodules can develop into complex nodules, and vice versa

A nodule from (A) a ground-glass nodule (arrow) to (B) a nodule with ground-glass (solid arrow) and soft tissue and cystic (open arrow) components



Location for Nodule

- ❑ Nodules can be described as peribronchovascular or centrilobular, depending on their location in relation to other structures.
- ❑ Nodules arising from a fissure* should be called “**fissural**.” Nodules with direct contact to a fissure*, but not arising from it, should be called “**perifissural**”
- ❑ Nodules arising from the pleura* should be called “**pleural**.” Nodules with direct contact to the pleura*, but not arising from it, should be called “**pleura-based**.” The term “**subpleural**” should only be used for nodules in proximity to the pleura, but without direct contact to it.



Step-wise approach for morphological assessment of the solitary pulmonary nodule

Density	1. Solid 2. Subsolid (part-solid, GGO)
Shape	3. Round or oval 4. Triangular or polygonal
Margins	5. Smooth 6. Lobulated 7. Spiculated
Internal characteristics	8. Fat 9. Calcification 10. Cavitation
Complex findings	11. Pleural retraction 12. Air bronchogram 13. Bubble like lucencies 14. Cystic Airspace 15. Vascular convergence

Imaging technique and size measurement

Incidental Pulmonary Nodules (IPN)

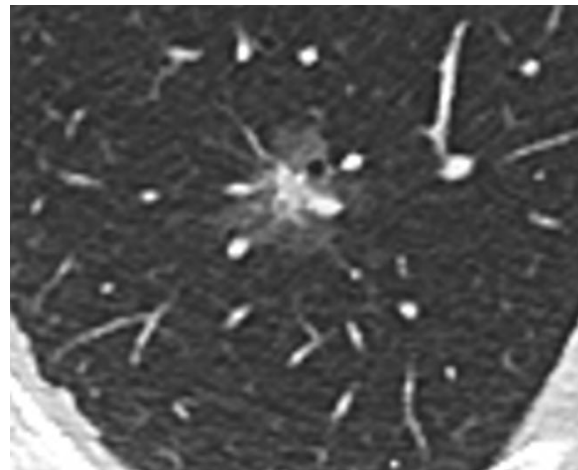
- IPNs are nodules that were found in a **screening program** or in CT scans for an **unrelated reason**
- Common in the population (10 - 59%), chest CT scans (30%)
- Size: >3 mm and ≤3 cm in diameter
- More rounded structures having a sharp or indistinct border to the surrounding tissue
- Density: solid or subsolid nodules (GGO, part-solid)
- Almost 6- 10% of patients (solid > 8 mm) will receive a lung cancer diagnosis



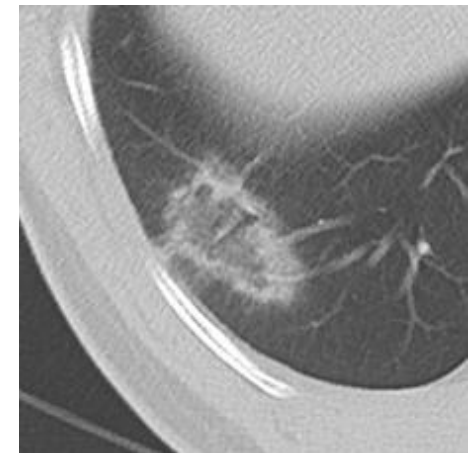
Solid



Pure GGO



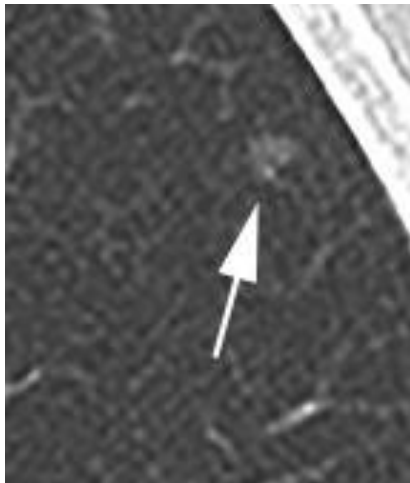
Part-solid



Reverse halo

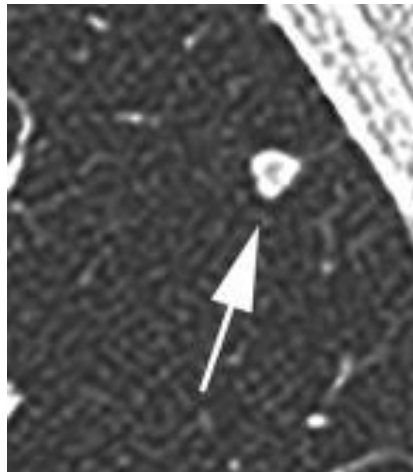
CT Technique Aids in Nodule Management

- Thin-section CT images (≤ 1.5 mm, ideally 1.0 mm), high-frequency reconstruction (HRCT), lung window (WW: 1600,WL: -600)
- Axial, coronal and sagittal **reformats** facilitate characterization of lesions
- A soft tissue or low-frequency reconstruction algorithm better for assessing the presence of calcification and fat-attenuation nodules

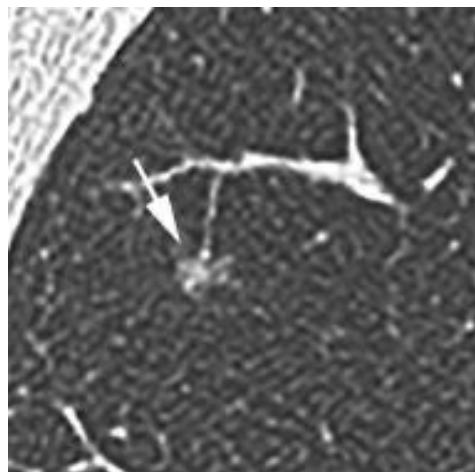


5 mm section

minimize volume averaging

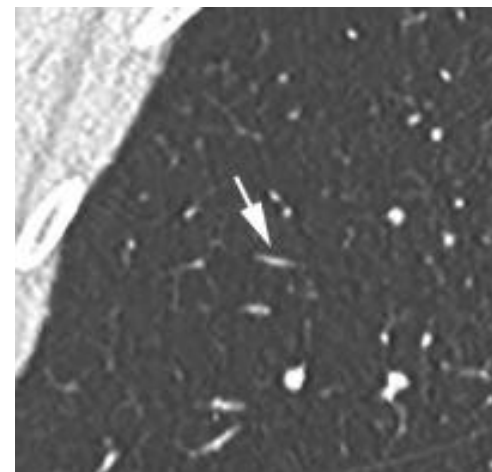


1 mm section

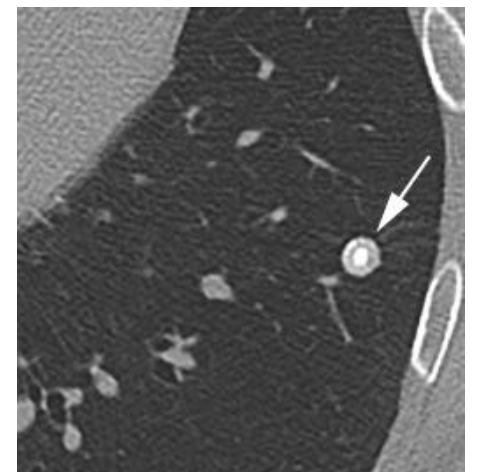


Axial

perifissural nodule



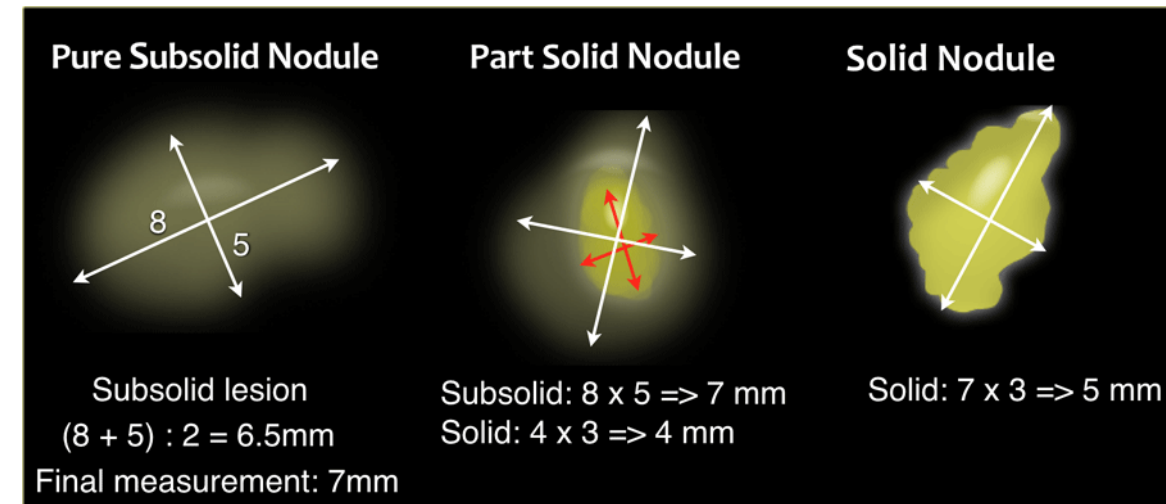
Sagittal



central calcification

Measurement of Lung Nodules

- Thin section (1 mm), MPR (axial, sagittal, coronal reconstructions) , lung window settings with sharp filter
- One-dimensional (1D) (RECIST) (TNM staging)
 - Long axis, moderate agreement values (κ , 0.56)
 - Significant change (≥ 2 mm)
- Two-dimensional (2D) (Fleischner guidelines) (screening)
 - Average of long and short axis on the same plane (axial) (≥ 2 mm), (nodule growth, ≥ 1.5 mm/year)
- 3D dimensional (3D)
 - volume (semi-automated/automated techniques)
 - Significant change ($\geq 25\%$)



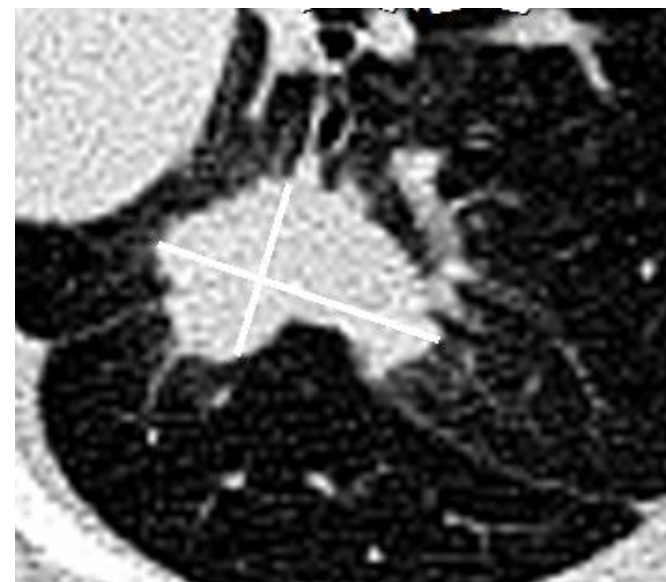
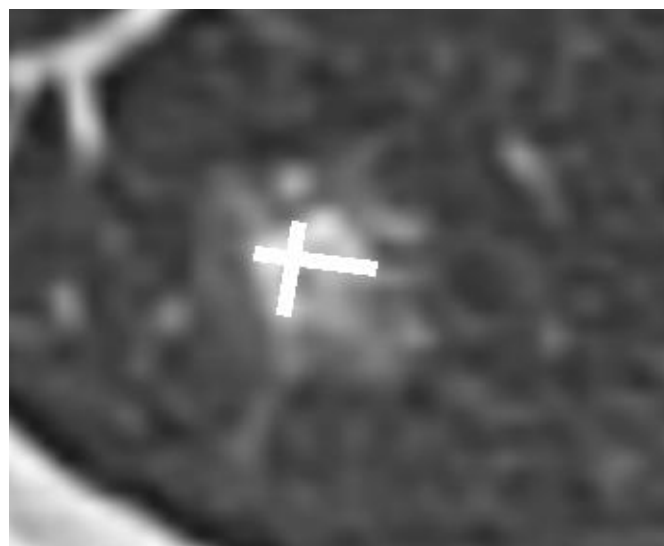
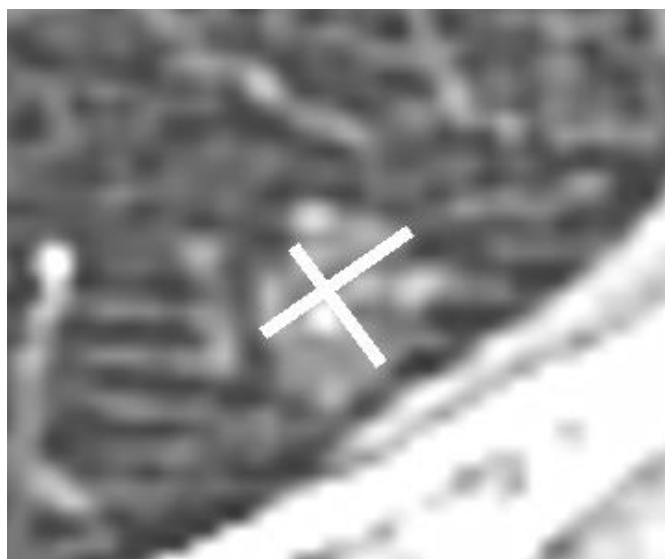
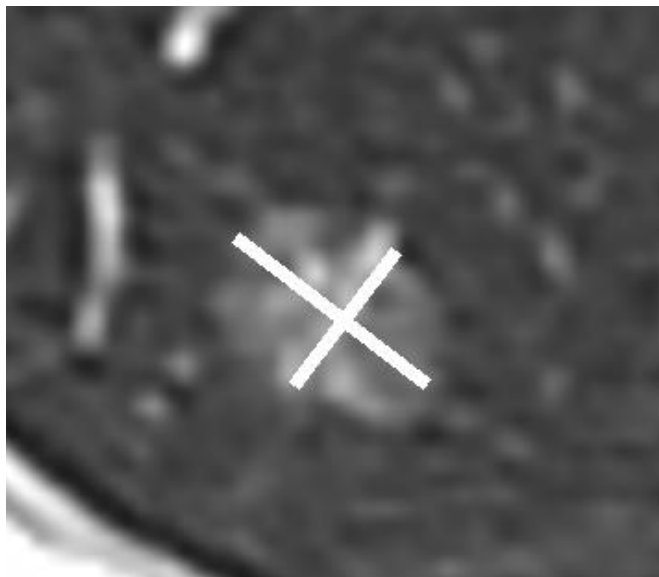
肺篩 Modified Lung RAD

建議:

1.長短軸平均值

2.記錄到小數點一位

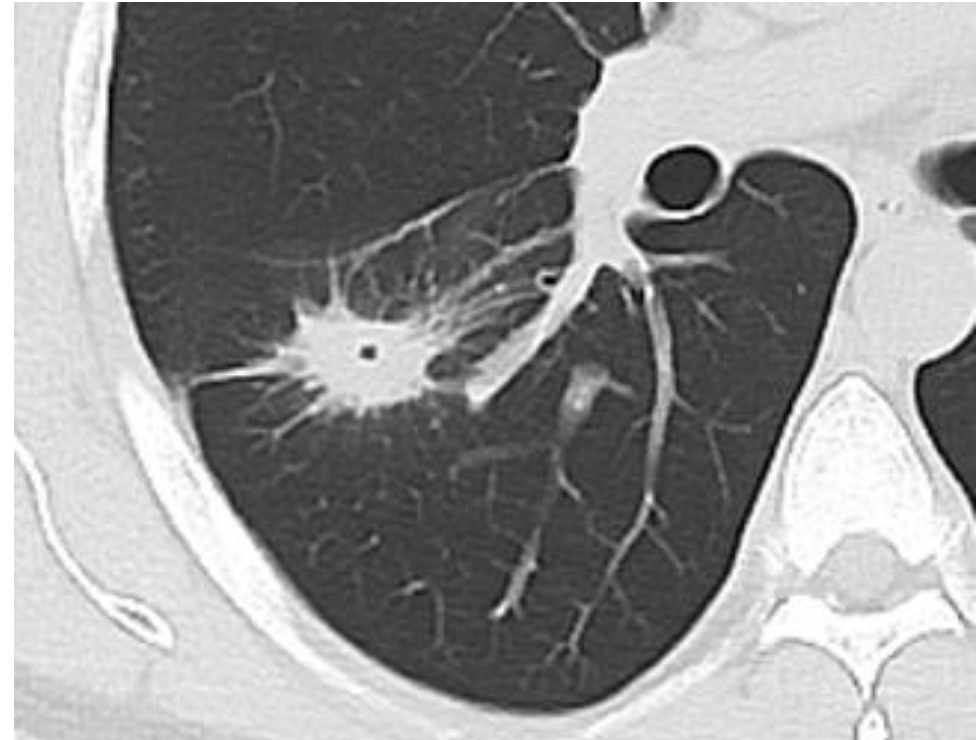
例如 6.2 mm

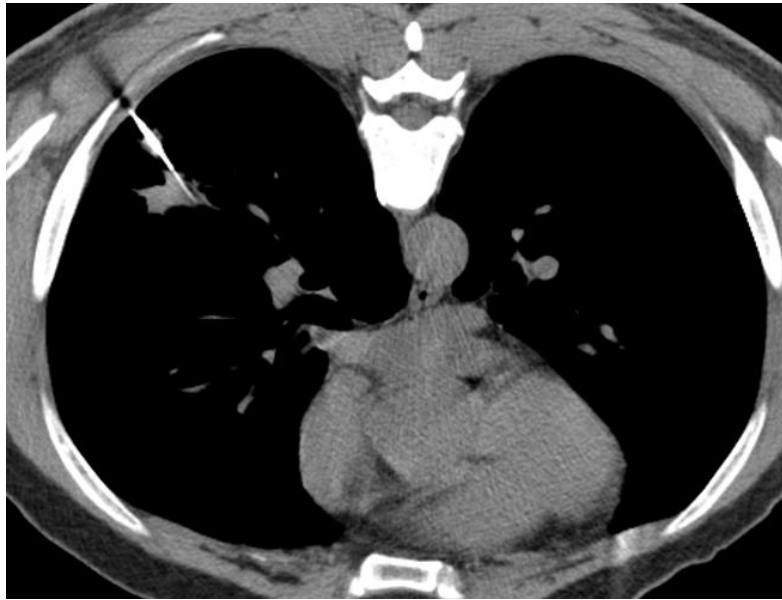


Differentiation of malignant/benign lesions

Never a certainty, but always our utmost effort

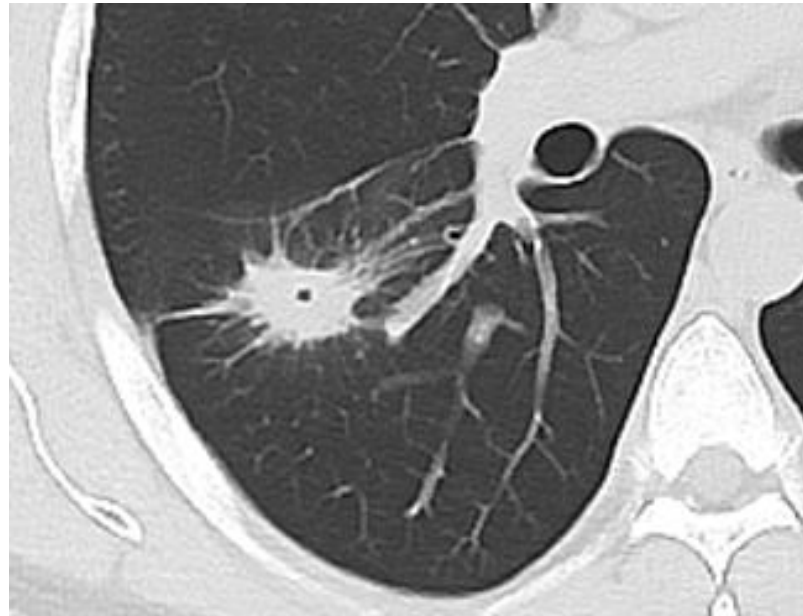
Doc, is there malignant tumor in my lung?





Computed tomography-guided biopsy, **organizing pneumonia**.

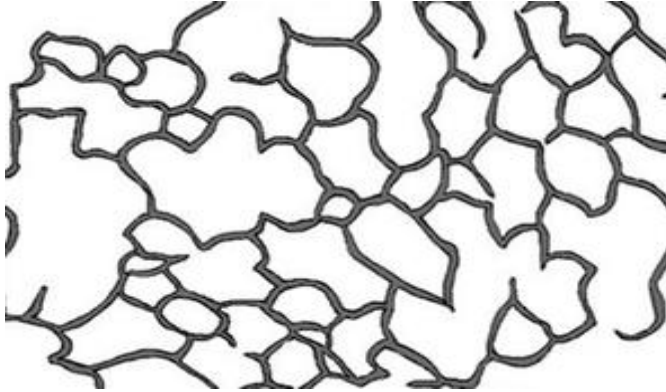
- ❑ Lung tissue with organizing pneumonia characterized by acute and chronic inflammation and **intra-alveolar fibroblastic plugs (Masson body)**.



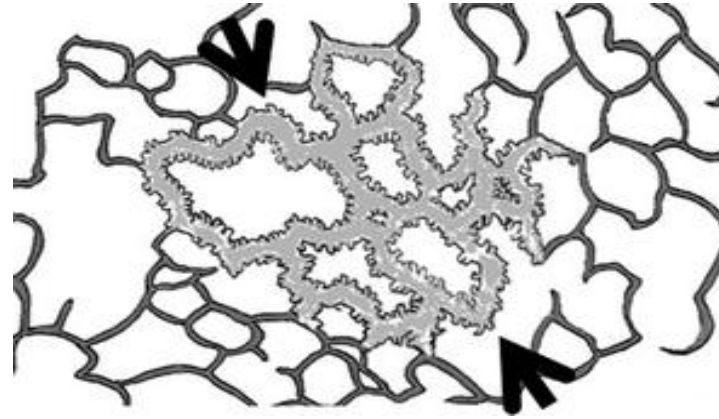
Prednisolone
0.25mg/kg for
3 months



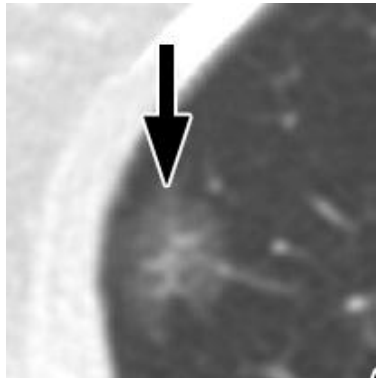
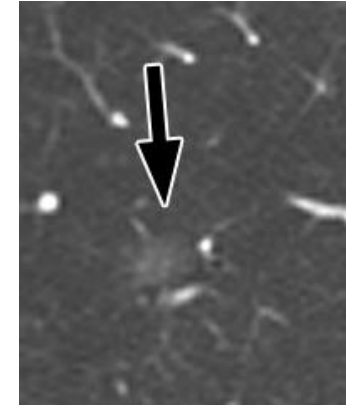
Adenocarcinoma (ADC): correlation of image and pathology findings



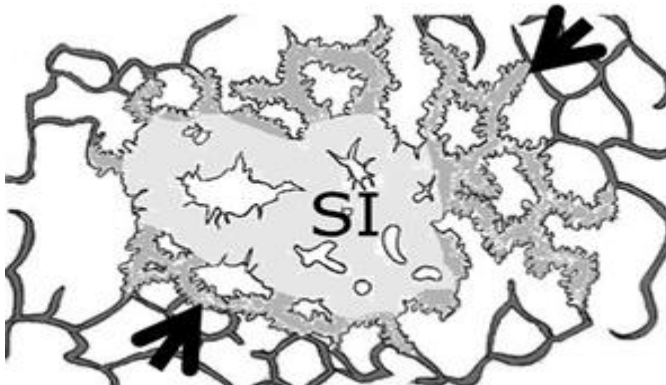
Normal



Atypical adenomatous hyperplasia (AAH) GGO
Adenocarcinoma in situ (AIS)



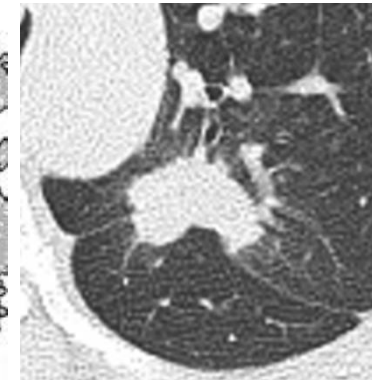
Part-solid



Minimally invasive adenocarcinoma (MIA) (stromal invasion $\leq 5\text{mm}$)

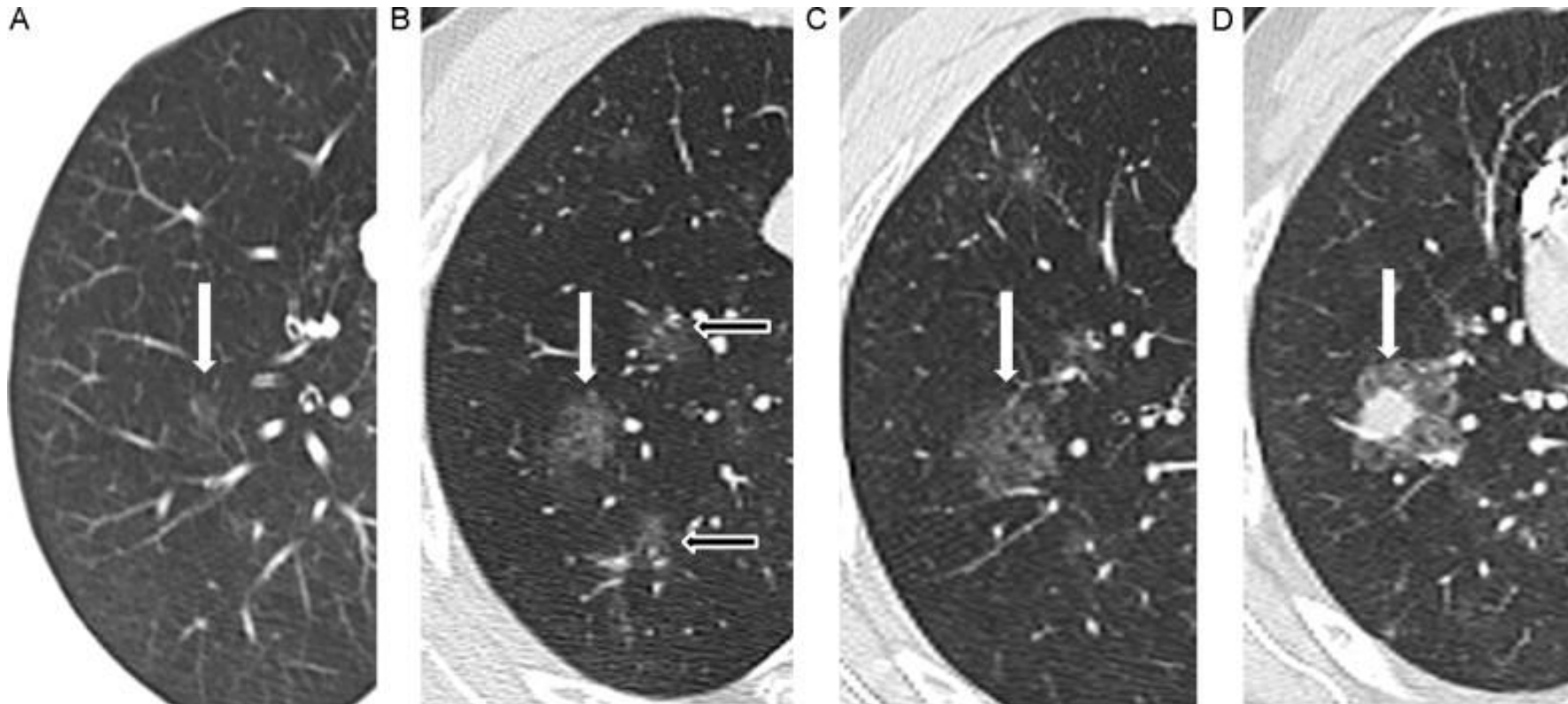


Invasive adenocarcinoma (IA)
(stromal invasion $> 5\text{mm}$)



Solid

Lung Adenocarcinoma (IASLC/ATS/ERS)



AAH GGO $\leq 5\text{mm}$

AIS, GGO $\leq 3\text{ cm}$

MIA (GGO $\leq 3\text{ cm}$, solid $\leq 5\text{ mm}$)
IA (GGO $> 3\text{ cm}$, solid $> 5\text{ mm}$)

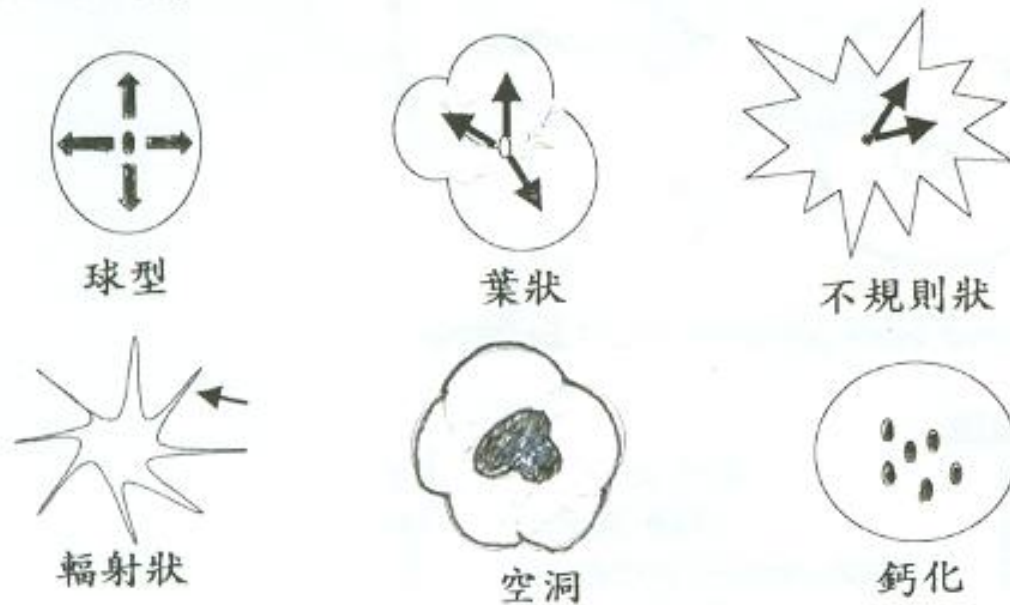
Incidental (small) lung nodule (< 10 mm)

Diameter size (solid nodule)	Risk of being cancerous
1–2 mm (miliary nodules)	very small risk
< 6 mm (micronodule ≤ 3 mm)	0%–1%
6–8 mm	0.5%–2.0%
> 8 mm	9.7%
> 10 mm	15.2%
> 30 mm (mass)	Usually considered malignant

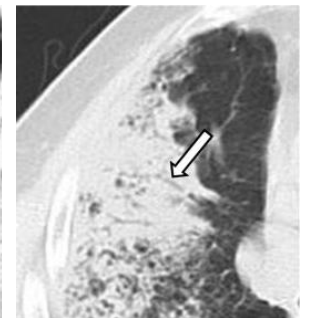
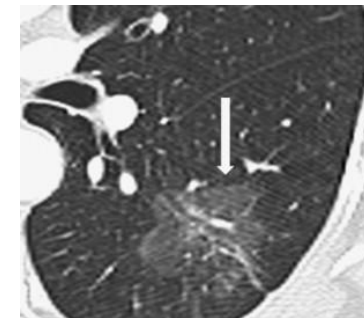
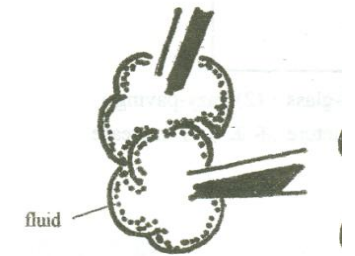
Tumor growth

Expansile growth

❖ 惡性腫瘤之生物行為模型



Lepidic growth

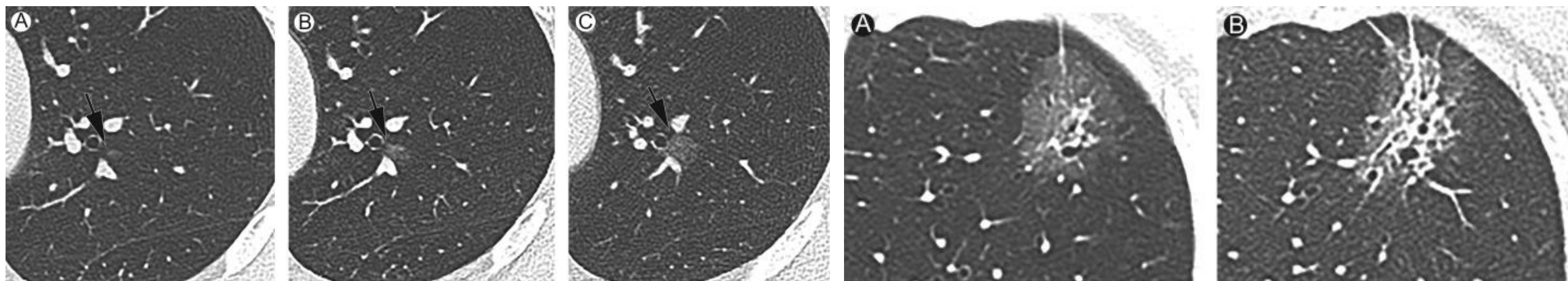


Doubling time: the time of **diameter increase 1.26X**

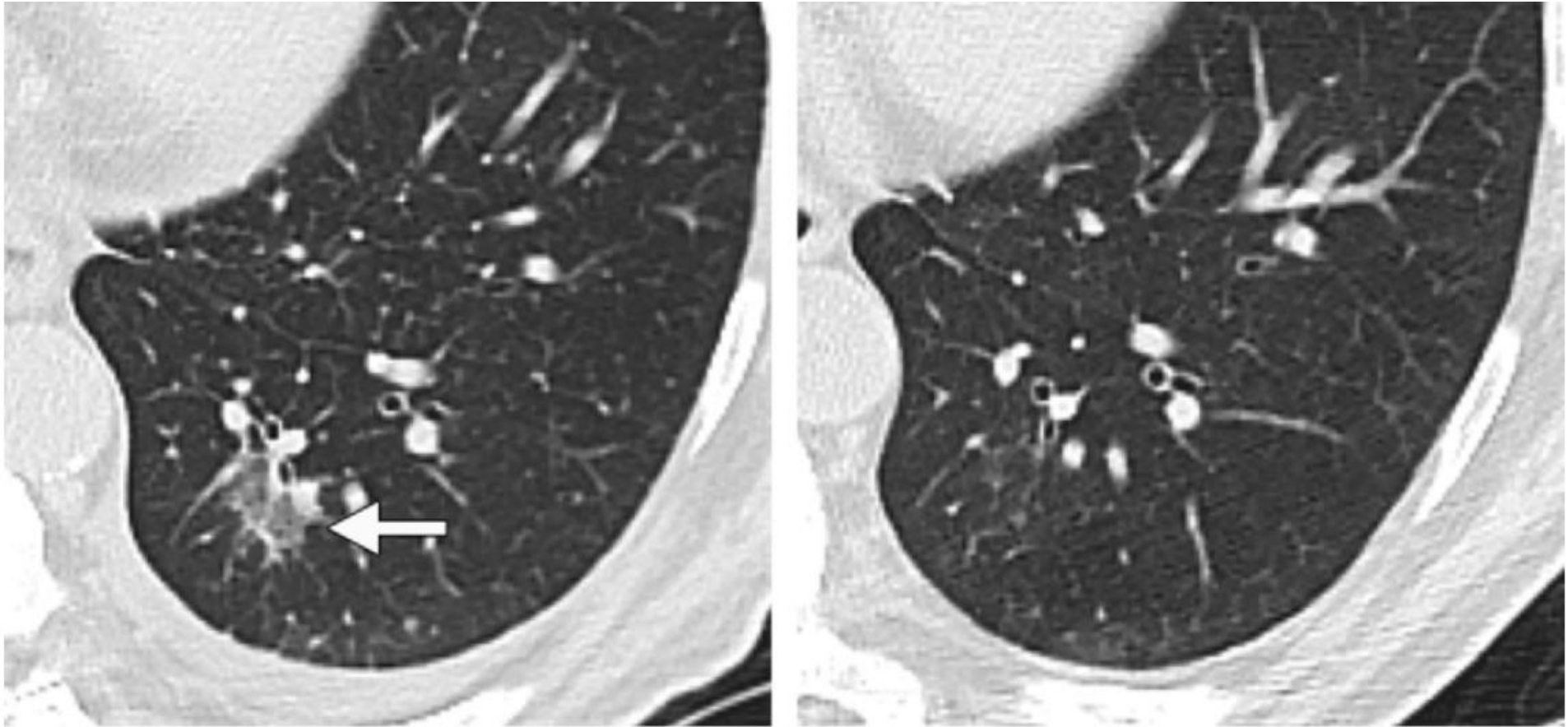
Doubling time malignant lesions: 20–400 days

Nodule Growth

- Volume doubling time:
 - Solid nodule (30 - 400 days)
 - GGNs (5 years)
 - part-solid nodules (< 5mm solid areas) (3.4 years)
 - part-solid nodules (> 5mm solid areas) (2.1 years)
 - AIS (3.4 years), MIA (3.6 years) , and invasive adenocarcinoma (2.6 years)
- Small pGGNs (≤ 5 mm) (probably AAH, a preinvasive lesion)
 - likelihood of progression (10.3%) with follow up for at least 5 years and **1%** of developed into cancers.
 - solid components developed (3.6 years), ≥ 5 mm (4.7 years) for their resected adenocarcinomas in an Asian cohort



Leukemia with infection/inflammation process

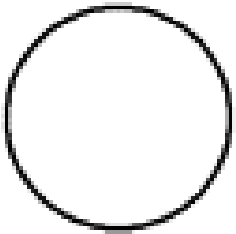


3 months later

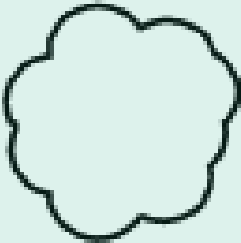
Solitary pulmonary nodule: Shape/Margin

- Likelihood of malignancy:
 - Benign: round, polygonal
 - Malignant: lobulated, spiculated and ragged nodules

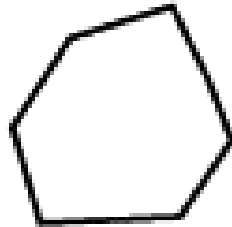
Round/Oval



Lobulated



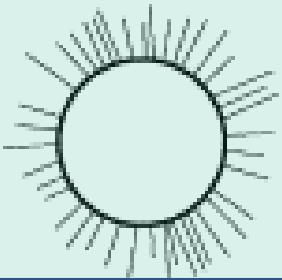
Polygonal



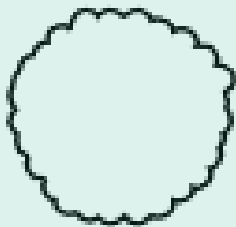
Tentacular



Spiculated

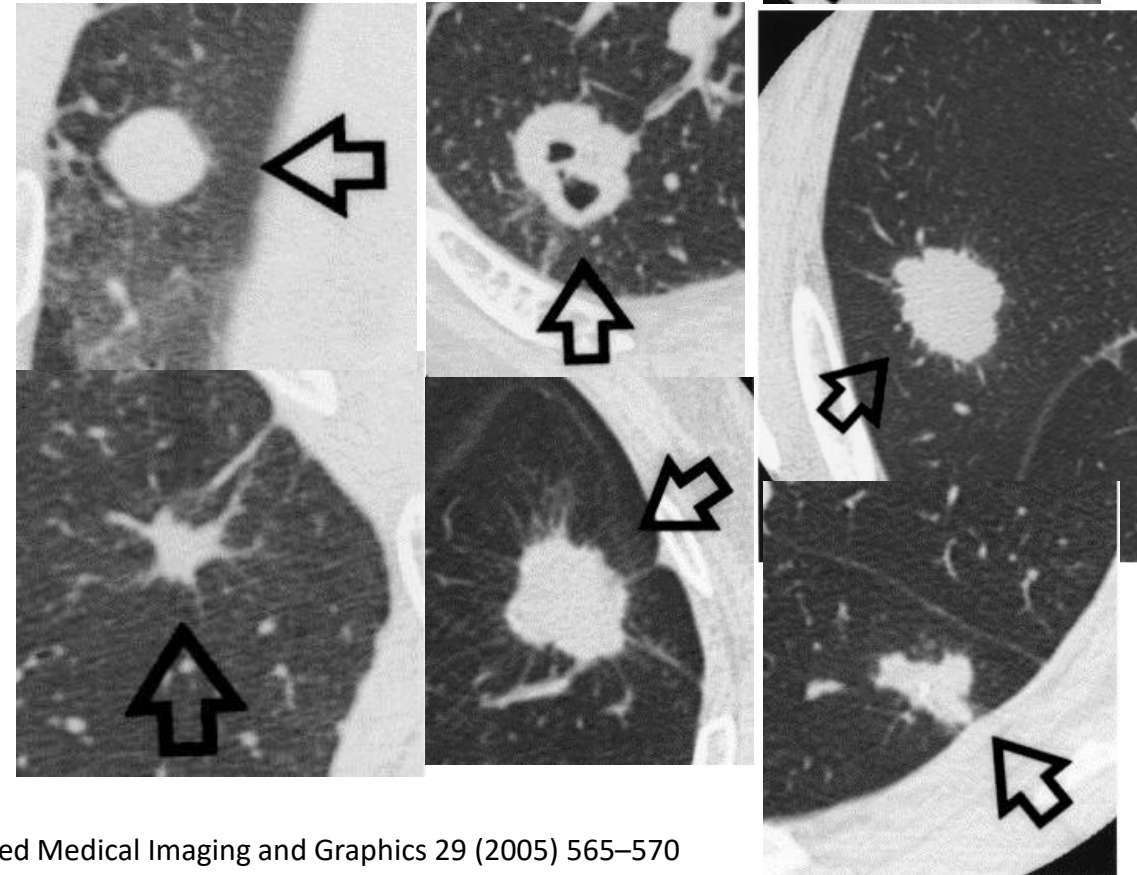


Ragged



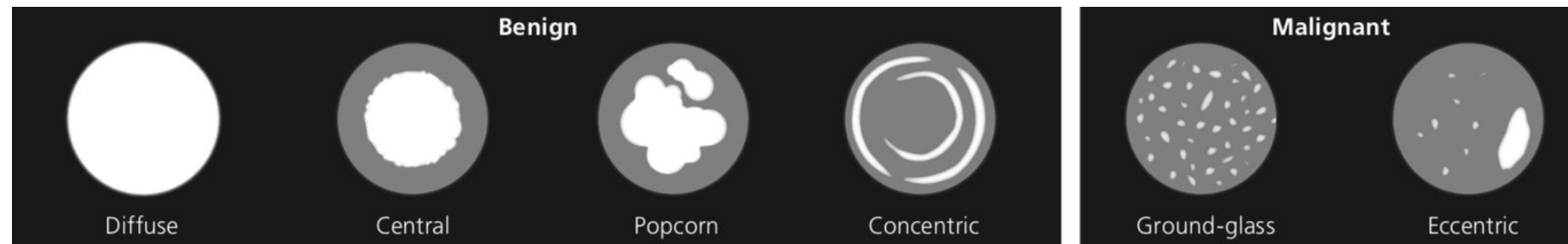
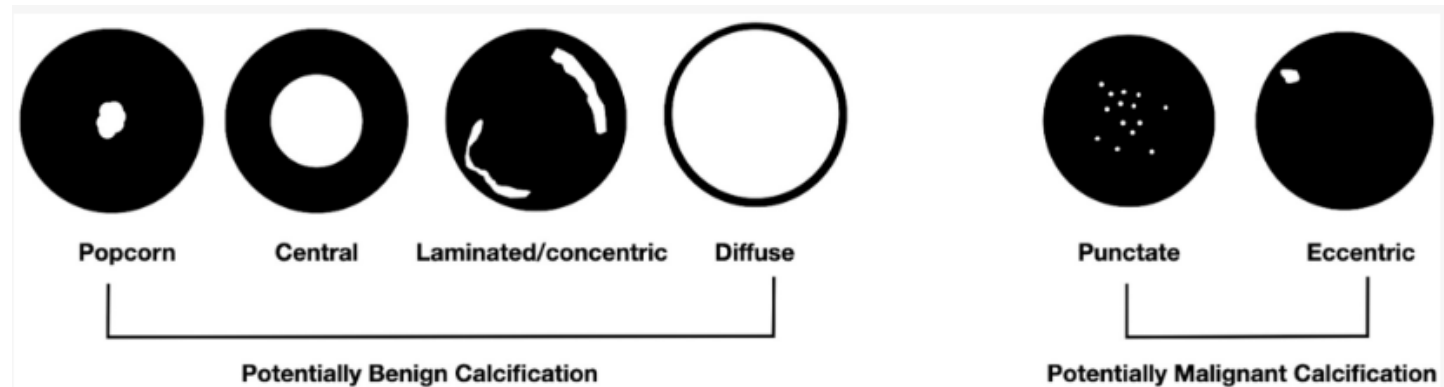
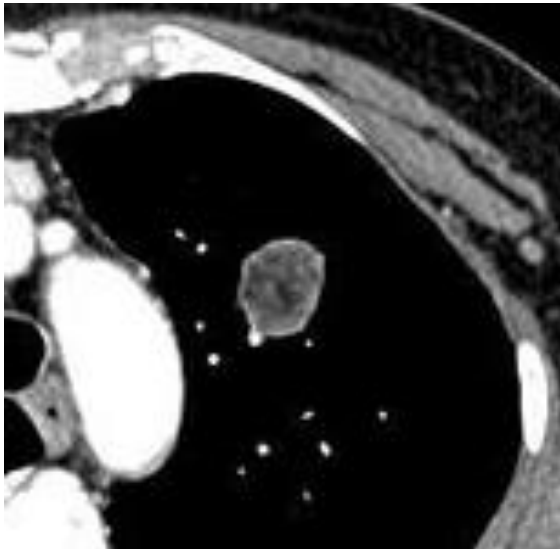
Irregular

Exceptions to the other shapes



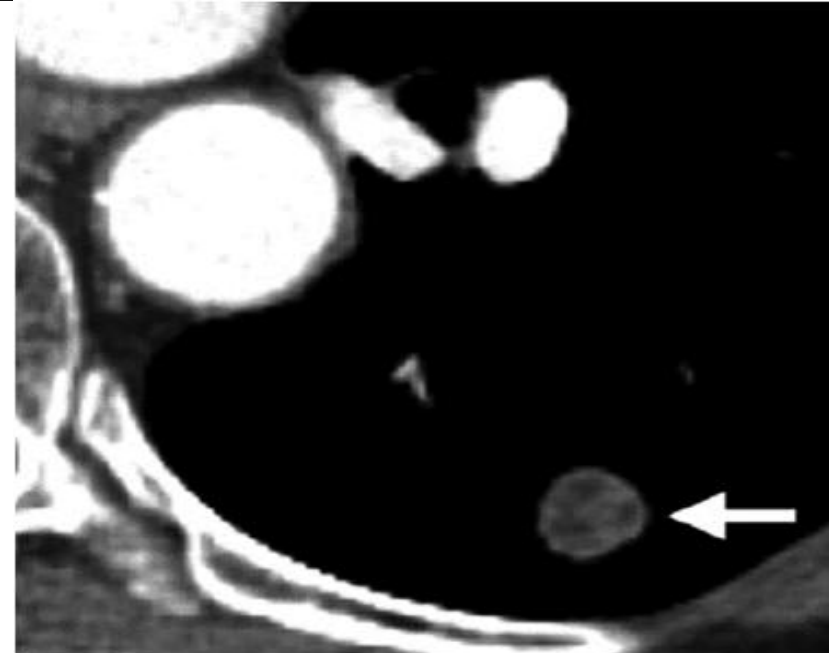
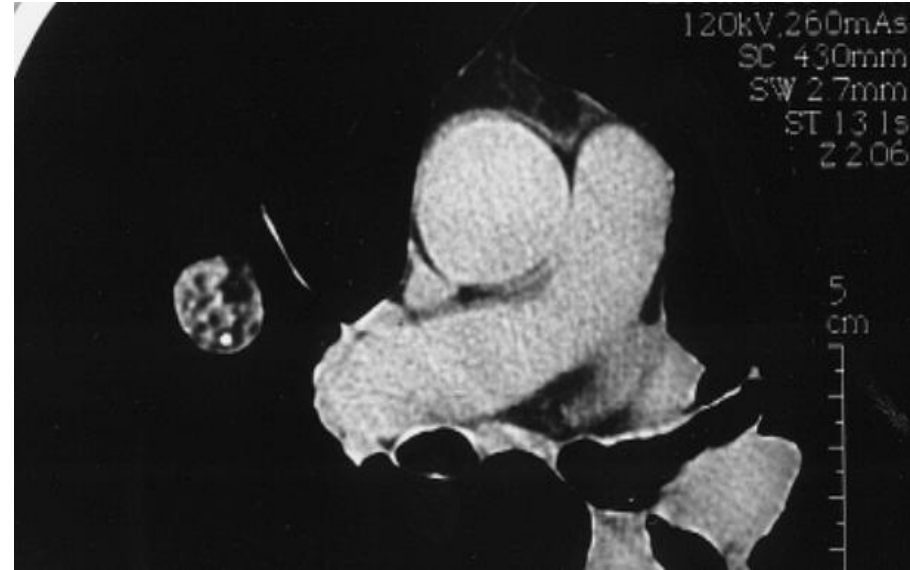
Solitary pulmonary nodule: Internal characteristics

- Evaluation of the nodule in soft tissue and bone window
- Intranodular fat: -40 to -120 H.U.
- Calcification:
Benign nodules: central, diffuse solid, or laminated
Malignant nodules: **amorphous or punctate**
- Cavitation: Associated ground glass, consolidation, bronchial wall thickening, and the presence of **satellite nodules** are indicative of a benign nature of the cavitary nodule.



Pulmonary hamartomas

- Made up of cartilage, connective tissue, fat, muscle and bone.
- Fat -40 to -120 HU
- Up to 50% of pulmonary hamartomas demonstrate fat attenuation on initial CT
- Differentials for fat attenuation in a SPN include lipoid pneumonia or pulmonary metastases in liposarcoma or renal cell carcinoma.



Solitary pulmonary nodule: Air bronchograms

- Tumor–bronchus relationships

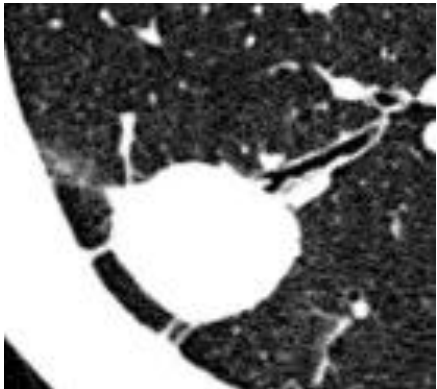
Type I: bronchus was obstructed abruptly by the nodule (High)

Type II: bronchus penetrated into the tumor with tapered narrowing and interruption (High)

Type III: bronchial lumen shown within the tumor was patent and intact (Moderate-High)

Type IV: bronchus ran around the periphery of the tumor with intact lumen (Low)

Type V: bronchus was similar to that of type IV but displaced, compressed and narrowed by the tumor (Indeterminate)



Type I



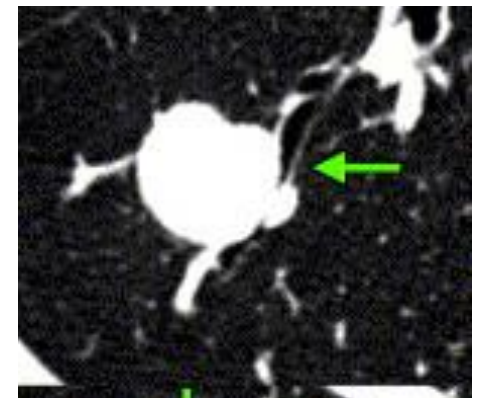
Type II



Type III



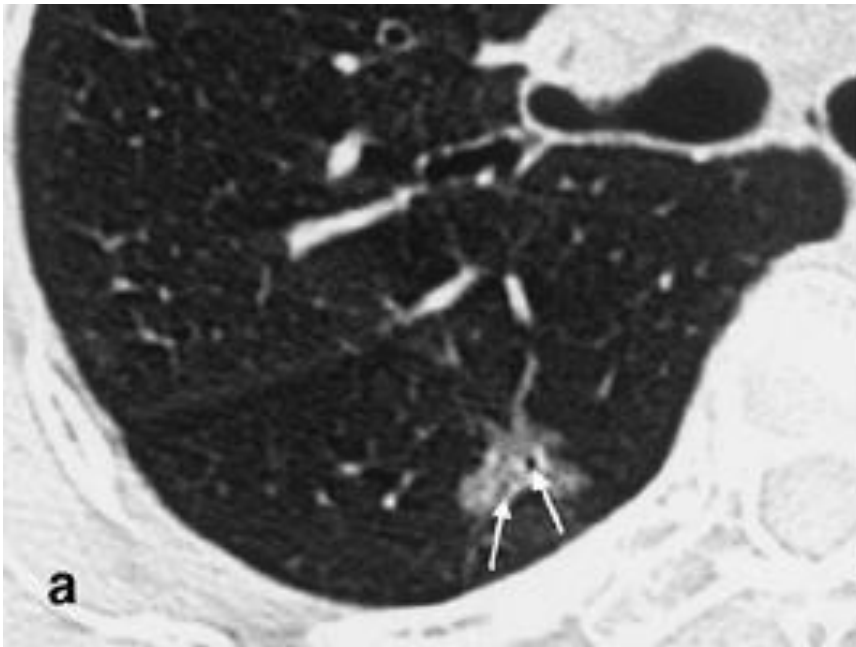
Type IV



Type V

Solitary pulmonary nodule: Bubble-like lucencies

- Small patent air containing bronchi (**tumor bronchial plugging**) in the nodule
- When seen in subsolid nodules (in particular part-solid nodules), the finding is slightly more common in invasive adenocarcinomas than in preinvasive lesions



Bubble-like appearance

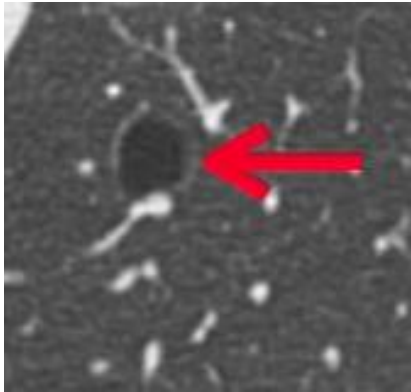


Air bronchogram

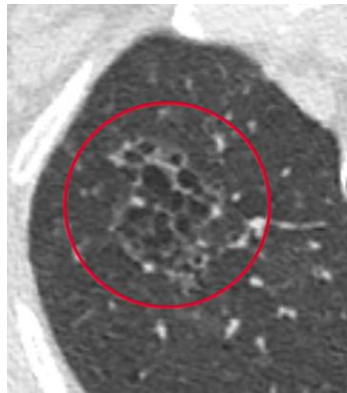


Solitary pulmonary nodule: Atypical pulmonary cyst

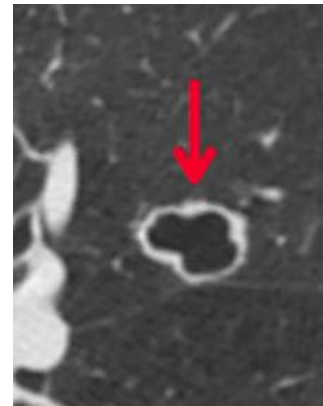
- **Thick** cyst wall (≥ 2 mm) or **multiloculate cyst**, suspicious of malignancy
- 2% of cancers at baseline and 12% at annual screening , 22.7% of the missed cancers in the NELSON lung cancer screening trial
- Adenocarcinoma, squamous and small cell carcinomas
- Current hypotheses
 1. A check-valve mechanism involving the small airways leading to outflow obstruction,
 2. Cystification of tumor
 3. Growth of adenocarcinoma along the wall of a preexisting bulla



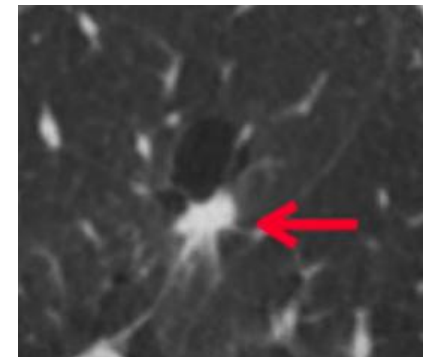
Cyst



Multilocular cyst
Lung RADS 4A



Thick wall cyst
4A



Cyst with associated nodule
4B

ATYPICAL PULMONARY CYSTS

Lung-RADS 3

- Growing cystic component of a thick-walled cyst (total mean diameter)

6-month LDCT

Lung-RADS 4A

- Thick-walled cyst **OR**
- Multilocular cyst at baseline **OR**
- Thin- or thick-walled cyst that becomes multilocular

3-month LDCT; PET-CT

Lung-RADS 4B

- Thick-walled cyst with new or growing wall thickness/nodularity **OR**
- Growing multilocular cyst (mean diameter) **OR**
- Multilocular cyst with increased loculation or new/increased opacity (nodular, ground glass)

CT; PET-CT; Bx; Referral

Solitary pulmonary nodule: Linear extension

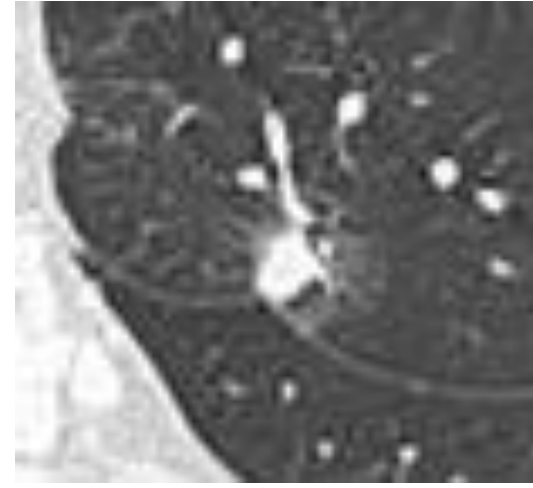
- Pleural retraction: pleural retraction in a pure ground glass nodule is a predictive factor for invasiveness.
- Pleural tags
- Pulmonary vessel extension



Interlobular extension



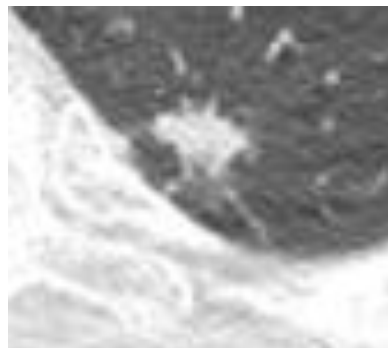
Vessel extension



Pleural retraction

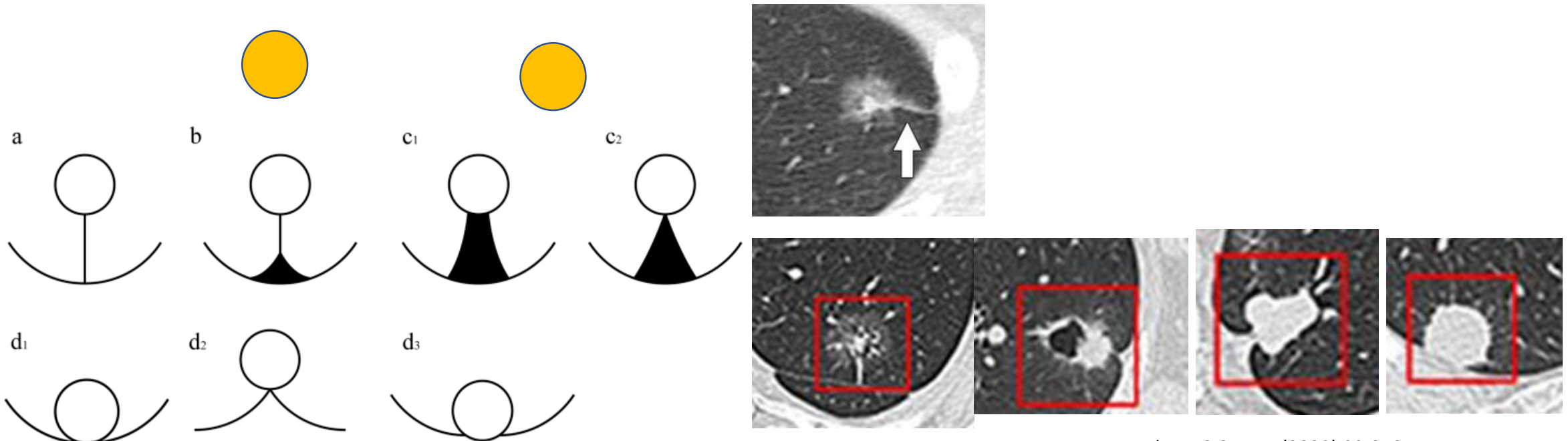


Pleural tags



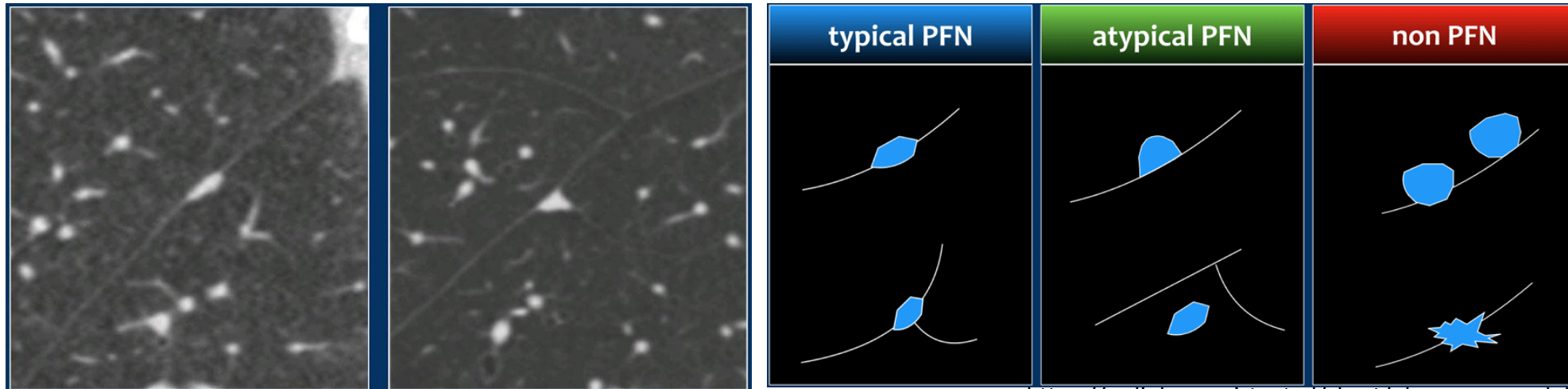
Solitary pulmonary nodule: Pleural tag

- Pleural retraction: pleural retraction in a pure ground glass nodule is a predictive factor for invasiveness.
- Pleural tags: In a nodule **not abutting the pleura**, a pleural **tag with soft-tissue component** at the pleural end (to evaluate in mediastinal window) suggests visceral pleural invasion



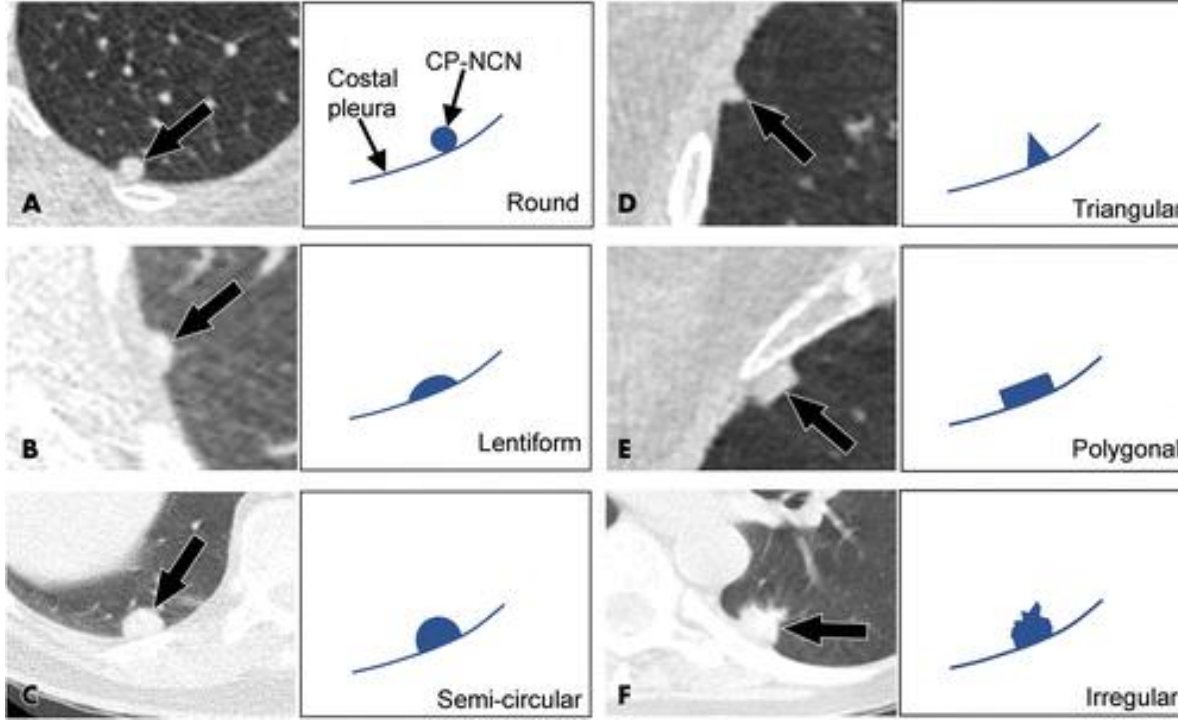
Solitary pulmonary nodule: Pleural distance

- **Typical PFN**: fissure-attached nodules with a lentiform, oval or triangular .
- **Atypical PFN**: nodules with a lentiform, oval or triangular shape, but **not attached** to a (visible) fissure or fissure attached, convex **on one side** and rounded on the other side
- **Non-PFN**: Fissure-(un)attached nodules with a spherical or irregular shape that did not appear to be influenced by the fissure.
- **Perifissural nodules** :
 - low likelihood of malignancy and correlated with intraparenchymal **lymph nodes** in screening subjects
 - metastatic disease can manifest as a perifissural nodule, and therefore nodules in such patients should not be readily dismissed as benign.
- * Nodules with the majority of lymph node characteristics, regardless of location, are likely benign



Solitary pulmonary nodule: shape of subpleural nodule

- Noncalcified nodules (≤ 10 mm) attached to the costal pleura
- Shape:
 - (a) Lentiform, oval, or semicircular (LOS) and triangular
 - (b) Round and polygonal
 - (c) Irregular
- Noncalcified nodules with LOS or triangular shapes and smooth margins were benign, and smooth margins were benign.



Solitary pulmonary nodule: vascular convergence sign

- ❑ Vessels converging to a nodule without adjoining or contacting the edge of the nodule and is mainly seen in peripheral subsolid lung cancer
- ❑ Malignancy rate of 85.2% in subsolid nodule
- ❑ But 40.0% of benign nodules demonstrated vascular convergence sign

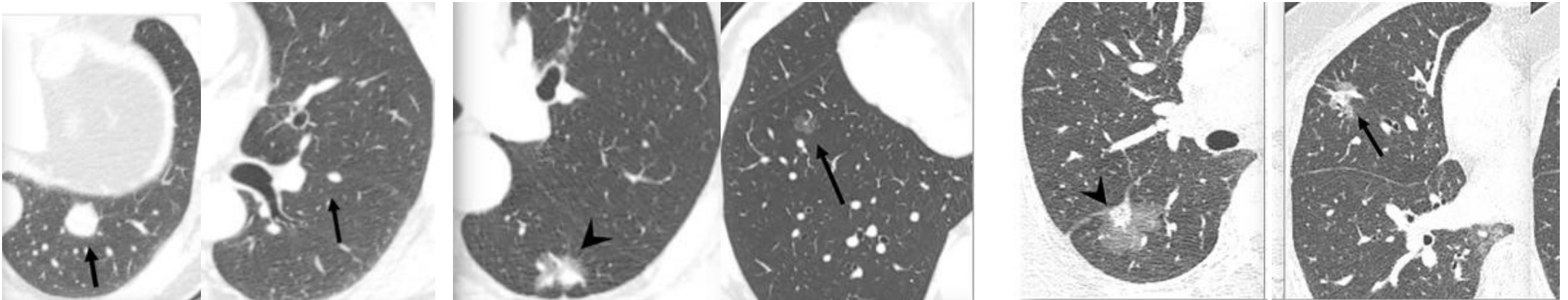


New Nodules

- **NELSON screening trial:**
 - **New solid nodules:**
 - * **5% and 7% at 2nd and 3rd round, respectively.**
 - * **cancer (4%) of all new nodules**
 - * **new nodule < 4 mm (a low probability of lung cancer of 0.5% vs 1st nodule <1%), 4-7 mm (3.1%), $\geq$ 8 mm (16.9 %)**
 - **New subsolid nodules: more likely to resolve or decrease in size . (1/3-1/2)**
- * **New solid nodules: high risk of metastases in oncological patients**

Multiple Primary Lung Cancers vs Intrapulmonary Metastases

- Multiple Primary Lung Cancers
GGO. partial solid nodule
Solid nodule with **spiculation or airbronchograms**
- Intrapulmonary metastases
Solid nodules **without** spiculation or airbronchograms



Intrapulmonary metastasis

Multiple primary lung cancers

Multiple primary lung cancers

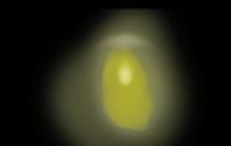
Risk factor of lung cancer defined by Fleischner Society

Risk factors

- History of heavy smoking
- Exposure to asbestos, radon or uranium
- Family history of lung cancer
- Older age
- Sex (Females > Males)
- Race (Black and native Hawaiian > White)
- Marginal spiculation
- Upper lobe location
- Multiplicity (<5 nodules increases risk for malignancy)
- Emphysema and pulmonary fibrosis (particularly IPF)

CT follow up recommendation by Fleischner Society

Solid	Size	Follow up		
	< 6 mm (<100mm ³)	Single	Low risk High risk	No routine follow Optional CT at 12 months
		Multiple	Low risk High risk	No routine follow Optional CT at 12 months
	6-8 mm (100-250mm ³)	Single	Low risk High risk	CT at 6-12 mo, then consider CT at 18-24 CT at 6-12 mo, then CT at 18-24
		Multiple	Low risk High risk	CT at 3-6 mo, then consider CT at 18-24 CT at 3-6 mo, then CT at 18-24
	> 8 mm (> 250mm ³)	Single	All	Consider CT at 3 mo, PET/CT or Biopsy
		Multiple	Low risk High risk	CT at 3-6 mo, then consider CT at 18-24 CT at 3-6 mo, then CT at 18-24

Subsolid	Size	Follow up
 Groundglass	< 6 mm	No FU indicated
	≥ 6 mm	CT at 6-12 months to confirm persistence, then CT at 3 and 5 years
 Part-solid	< 6 mm	No FU indicated
	≥ 6 mm	CT at 3-6 months to confirm persistence, then annual CT for 5 years
 Multiple	< 6 mm	CT at 3-6 months. If stable CT at 2 and 4 years
	≥ 6 mm	CT at 3-6 months. Subsequent management based on most suspicious nodule

Benign or malignant solitary nodules ?

	Benign	Malignancy
Age	<35 y/o	>35 y/o
Symptoms	absent	May present
Past history	TB exposure, non-smoker	Smoker, exposure to carcinogens
Size	Small (<2cm)	Larger (>2cm)
Contour	Smooth margin	Spiculated margin
Calcification	Almost benign if laminated, diffuse or central	Rare, may be eccentric
No change over past 2 yrs	Almost benign	Most unlikely
Doubling time	<30 or > 490 days	Between the extremes
CT – fat	Hamartoma	absent
CT - Bubble like lucencies	Uncommon	Common, especially in adenocarcinoma
CT - enhancement	<15 HU	>15 HU

Lung-RAD system

國民健康署肺癌篩檢服務

補助對象為

肺癌高風險族群

2年1次

有肺癌家族史

或

重度吸菸者

- **45-74歲男性**
- **40-74歲女性**
- 且父母、子女、兄弟姊妹曾罹患肺癌



- **50-74歲**
- 且吸菸史達**20包-年**以上
(仍在吸菸或戒菸未達15年)



包-年=每日吸菸包數 × 共吸菸幾年 如：每天1包菸，共抽20年；或每天2包菸，共抽10年

Lung-RADS® v2022

Lung-RADS	Category Descriptor	Findings	Management
0	Incomplete Estimated Population Prevalence: ~ 1%	Prior chest CT examination being located for comparison (see note 9)	Comparison to prior chest CT;
		Part or all of lungs cannot be evaluated	Additional lung cancer screening CT imaging needed;
		Findings suggestive of an inflammatory or infectious process (see note 10)	1-3 month LDCT
1	Negative Estimated Population Prevalence: 39%	No lung nodules OR	12-month screening LDCT
		Nodule with benign features: • Complete, central, popcorn, or concentric ring calcifications OR • Fat-containing	
2	Benign - Based on imaging features or indolent behavior Estimated Population Prevalence: 45%	Juxtapleural nodule: • < 10 mm (524 mm ³) mean diameter at baseline or new AND • Solid; smooth margins; and oval, lentiform, or triangular shape	
		Solid nodule: • < 6 mm (< 113 mm ³) at baseline OR • New < 4 mm (< 34 mm ³)	
		Part solid nodule: • < 6 mm total mean diameter (< 113 mm ³) at baseline	
		Non solid nodule (GGN): • < 30 mm (< 14,137 mm ³) at baseline, new, or growing OR • ≥ 30 mm (≥ 14,137 mm ³) stable or slowly growing (see note 7)	
		Airway nodule, subsegmental - at baseline, new, or stable (see note 11)	
		Category 3 lesion that is stable or decreased in size at 6-month follow-up CT OR Category 4B lesion proven to be benign in etiology following appropriate diagnostic workup	

Lung-RADS® v2022

3	Probably Benign - Based on imaging features or behavior Estimated Population Prevalence: 9%	Solid nodule: • ≥ 6 to < 8 mm (≥ 113 to < 268 mm³) at baseline OR • New 4 mm to < 6 mm (34 to < 113 mm³) Part solid nodule: • ≥ 6 mm total mean diameter (≥ 113 mm³) with solid component < 6 mm (< 113 mm³) at baseline OR • New < 6 mm total mean diameter (< 113 mm³) Non solid nodule (GGN): • ≥ 30 mm ($\geq 14,137$ mm³) at baseline or new Atypical pulmonary cyst: (see note 12) • Growing cystic component (mean diameter) of a thick-walled cyst Category 4A lesion that is stable or decreased in size at 3-month follow-up CT (excluding airway nodules)	6-month LDCT
4A	Suspicious Estimated Population Prevalence: 4%	Solid nodule: • ≥ 8 to < 15 mm (≥ 268 to $< 1,767$ mm³) at baseline OR • Growing < 8 mm (< 268 mm³) OR • New 6 to < 8 mm (113 to < 268 mm³) Part solid nodule: • ≥ 6 mm total mean diameter (≥ 113 mm³) with solid component ≥ 6 mm to < 8 mm (≥ 113 to < 268 mm³) at baseline OR • New or growing < 4 mm (< 34 mm³) solid component Airway nodule, segmental or more proximal - at baseline (see note 11) Atypical pulmonary cyst: (see note 12) • Thick-walled cyst OR • Multilocular cyst at baseline OR • Thin- or thick-walled cyst that becomes multilocular	3-month LDCT; PET/CT may be considered if there is a ≥ 8 mm (≥ 268 mm³) solid nodule or solid component

Lung-RADS® v2022

4B	Very Suspicious Estimated Population Prevalence: 2%	Airway nodule, segmental or more proximal - stable or growing (see note 11)	Referral for further clinical evaluation
		Solid nodule: • ≥ 15 mm (≥ 1767 mm³) at baseline OR • New or growing ≥ 8 mm (≥ 268 mm³)	Diagnostic chest CT with or without contrast; PET/CT may be considered if there is a ≥ 8 mm (≥ 268 mm ³) solid nodule or solid component; tissue sampling; and/or referral for further clinical evaluation Management depends on clinical evaluation, patient preference, and the probability of malignancy (see note 13)
		Part solid nodule: • Solid component ≥ 8 mm (≥ 268 mm³) at baseline OR • New or growing ≥ 4 mm (≥ 34 mm³) solid component	
		Atypical pulmonary cyst: (see note 12) • Thick-walled cyst with growing wall thickness/nodularity OR • Growing multilocular cyst (mean diameter) OR • Multilocular cyst with increased loculation or new/increased opacity (nodular, ground glass, or consolidation)	
		Slow growing solid or part solid nodule that demonstrates growth over multiple screening exams (see note 8)	
4X	Estimated Population Prevalence: < 1%	Category 3 or 4 nodules with additional features or imaging findings that increase suspicion for lung cancer (see note 14)	
S	Significant or Potentially Significant Estimated Population Prevalence: 10%	Modifier: May add to category 0-4 for clinically significant or potentially clinically significant findings unrelated to lung cancer (see note 15)	As appropriate to the specific finding

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Lung-RADS Category	類別敘述	影像發現	處置
0	不完整 (incomplete) 估計美國人群普遍性： ~1%	與先前的胸部 CT 進行比較(見註 9)	與先前的胸部 CT 比較
		部分或全部肺部無法評估	需要額外的肺癌篩檢 CT 成像
		可能為發炎或感染(見註 10)	1-3 個月後低劑量 CT
1	陰性 (negative) 估計美國人群普遍性： 39%	無肺結節，或	12 個月後篩檢低劑量 CT
		具有良性特徵的結節： • 完整、中心、爆米花狀或同心環狀鈣化 或 • 含脂肪	

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2	良性(benign) - 基於影像特徵或惰性行為 估計美國人群普遍性：45%	胸膜旁結節(juxtapleural nodule)： • 基線時(baseline screening)或新出現的平均直徑 < 10 mm (524 mm³) 且 • 實質；光滑邊緣；橢圓形、透鏡形或三角形	12 個月後篩檢低劑量 CT
		實質結節： • 基線時 < 6 mm (< 113 mm³) 或 • 新出現 < 4 mm (< 34 mm³)	
		部分實質結節： • 基線時平均直徑 < 6 mm (< 113 mm³)	
		非實質結節(毛玻璃結節)： • 基線時、新出現或生長中 < 30 mm (< 14,137 mm³) 或 • ≥ 30 mm (≥ 14,137 mm³) 穩定或緩慢生長(見註 7)	
		氣道結節，在亞節(subsegmental)支氣管 - 基線時、新出現或穩定(見註 11) - 類別 3，於 6 個月後追蹤 CT 穩定或縮小或 - 類別 4B，經適當診斷工作證實為良性病因	

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3	可能良性 (probably benign) – 基於影像特徵或行為 估計美國人群普遍性： 9%	實質結節：	6 個月後低劑量 CT
		• 基線時 ≥ 6 至 < 8 mm (≥ 113 至 < 268 mm³) 或 • 新出現 4 mm 至 < 6 mm (34 至 < 113 mm	
		³)	
		部分實質結節：	
		• 基線時平均直徑 ≥ 6 mm (≥ 113 mm³) 且實質成分 < 6 mm (< 113 mm³) 或 • 新出現 < 6 mm 總平均直徑 (< 113 mm³)	
		非實質結節(毛玻璃結節)：	
		• 基線時或新出現 ≥ 30 mm ($\geq 14,137$ mm³)	
		非典型肺囊腫：(見註 12)	
		• 厚壁囊腫的囊性成分(平均直徑)生長中	
		類別 4A，於 3 個月後追蹤 CT 時穩定或縮小(不包括氣道結節)	

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4A

可疑
(suspicious)
估計美國人
群普遍性：
4%

實質結節：

- 基線時 ≥ 8 至 < 15 mm (≥ 268 至 $< 1,767$ mm³) 或
- 生長中 < 8 mm (< 268 mm³) 或
- 新出現 6 至 < 8 mm (113 至 < 268 mm³)

部分實質結節：

- 基線時總平均直徑 ≥ 6 mm (≥ 113 mm³) 且實質成分 ≥ 6 mm 至 < 8 mm (≥ 113 至 < 268 mm³) 或
- 新出現或生長中 < 4 mm (< 34 mm³) 實質成分

氣道結節，在節(segmental)支氣管或更近端
– 基線時(見註 11)

非典型肺囊腫：(見註 12)

- 厚壁囊腫 或
- 基線時多房(multilocular)囊腫 或
- 薄壁或厚壁囊腫變為多房

- 3 個月後低劑量 CT
- 如果有 ≥ 8 mm (≥ 268 mm³) 的實質結節或實質成分，可考慮 PET/CT

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4B

高度可疑
(very
suspicious)
估計美國人
群普遍性：
2%

氣道結節，在節支氣管或更近端 - 穩定或生長中(見註 11)

實質結節：

- 基線時 $\geq 15 \text{ mm}$ ($\geq 1767 \text{ mm}^3$) 或
- 新出現或生長中 $\geq 8 \text{ mm}$ ($\geq 268 \text{ mm}^3$)

部分實質結節：

- 基線時實質成分 $\geq 8 \text{ mm}$ ($\geq 268 \text{ mm}^3$) 或
- 新出現或生長中 $\geq 4 \text{ mm}$ ($\geq 34 \text{ mm}^3$) 實質成分

非典型肺囊腫：(見註 12)

- 厚壁囊腫壁厚度/結節性增加 或
- 多房囊腫生長(平均直徑) 或
- 多房囊腫增加房室數或新出現/增加不透明度(結節狀、毛玻璃狀或實質化)

多次篩檢檢查間顯示生長的緩慢生長實質或部分實質結節(見註 8)

- 轉診進行進一步臨床評估

- 有或無對比劑的診斷性胸部 CT
- 如果有 $\geq 8 \text{ mm}$ ($\geq 268 \text{ mm}^3$) 的實質結節或實質成分，可考慮 PET/CT

- 組織取樣
- 和/或轉診進行進一步臨床評估

- 處置取決於臨床評估、患者意願和惡性腫瘤的概率(見註 13)

ACR Lung-RADS® 2022中文翻譯版-中華民國放射線醫學會

4X	估計美國人群普遍性： ＜1%	具有額外特徵或影像發現增加肺癌懷疑的類別 3 或類別 4 結節(見註 14)	診斷性檢查 - 處置取決於臨床評估、患者意願和惡性腫瘤的概率(見註 13)
S	重要或潛在重要 (significant or potentially Significant) 估計美國人群普遍性： 10%	修飾符(modifier)：可添加到類別 0-4，用於與肺癌無關的臨床重要或潛在臨床重要發現(見註 15)	根據具體發現適當管理

TAKE HOMES

- Nodules that are stable or decreased at follow-up can be downgraded to the next lower Lung-RADS category:



Take home message

- Solitary pulmonary nodule:

- ❑ Size matters, but do not ignore the power of morphology

- Benign nature :

- ❑ Nodules with smooth border, total or partly calcification, fatty component, solid density, very fast (<1 month) or rather long (>1 year) doubling time, and a size ≤ 6 mm in diameter , perifissural or subpleural nodules

- Malignant nature:

- ❑ Nodules with speculation, lobulation , and pleural retraction, persistent subsolid morphology

- ❑ More complex findings: bronchial abnormalities, bubble-like lucencies, an associated cystic airspace and vascular convergence sign



Thanks for your listening!