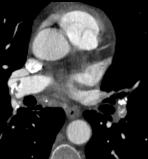



Pulmonary Hypertension

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University of Wisconsin
School of Medicine and Public Health

CHESTRAD 2023
A Case Review and Lecture Series
Saturday 15th July - Sunday 16th July - Monday 17th July
27 CPD Points

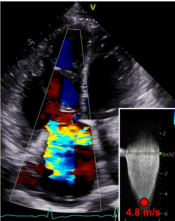
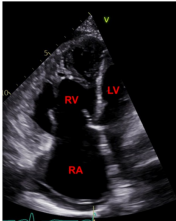
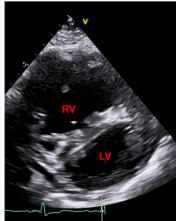
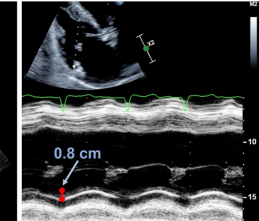
1

Introduction

- Pulmonary hypertension is now defined as mean pulmonary arterial pressure (mPAP) > 20 mmHg
- Pulmonary vascular resistance (PVR) > 2 Wood units (WU) also included
- Right heart catheterization is reference standard for diagnosis
- Transthoracic echocardiography often first line screening exam

2

Introduction

TR¹

Right chamber enlargement

Flattening of interventricular septum











TAPSE²

¹Tricuspid regurgitation
²Tricuspid annular plane of systolic excursion

Maron BA. *J Amer Heart Assoc* 2023

3

Introduction

Pulmonary arterial hypertension (PAH)	PH associated with left heart disease	PH associated with lung disease	PH associated with pulmonary artery obstructions	PH with unclear and/or multifactorial mechanisms
				
<ul style="list-style-type: none"> • Idiopathic/heritable • Associated conditions 	<ul style="list-style-type: none"> • LpcPH • CpcPH 	<ul style="list-style-type: none"> • Non-severe PH • Severe PH 	<ul style="list-style-type: none"> • CTEPH • Other pulmonary obstructions 	<ul style="list-style-type: none"> • Hematologic disorders • Systemic disorders
PREVALENCE				
Rare 	Very common 	Common 	Rare 	Rare 

Maron BA. *J Amer Heart Assoc* 2023

4

Introduction

- Imaging essential part in the diagnosis of patients with suspected or known pulmonary hypertension (PH)
 - Signs
 - Etiology
 - Function
 - Response to treatment

5

Objectives

- Review causes of pulmonary hypertension
- Illustrate imaging features of PH using a case-based approach
- Form differential diagnosis for causes of pulmonary

6

Radiography

- Chest radiography can show signs of pulmonary hypertension and left heart dysfunction
- Disease often more advanced when apparent
- Far less sensitive than cross-sectional modalities

7

Computed Tomography

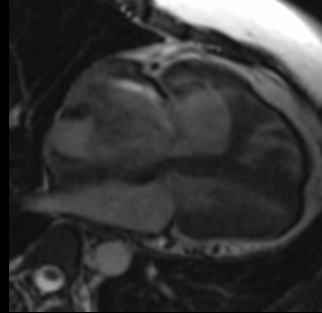
- Lungs
 - Vessel morphology
 - Parenchymal abnormality or disease
 - Shunts
- Cardiac
 - Chamber morphology
 - Shunts



8

MRI

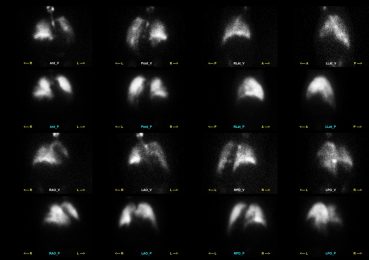
- Lungs
 - Vessel morphology
 - Shunts
- Cardiac
 - Chamber morphology
 - Function



9

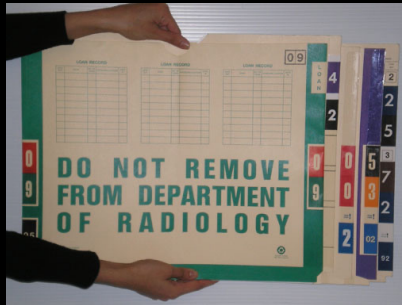
V/Q Scan

- Reference standard to assess for chronic thromboembolic disease
- In reality, V/Q is used in conjunction with CT angiography

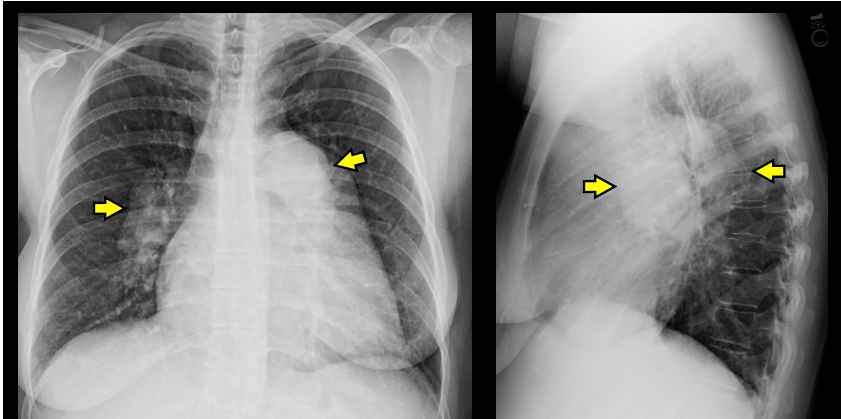


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Cases

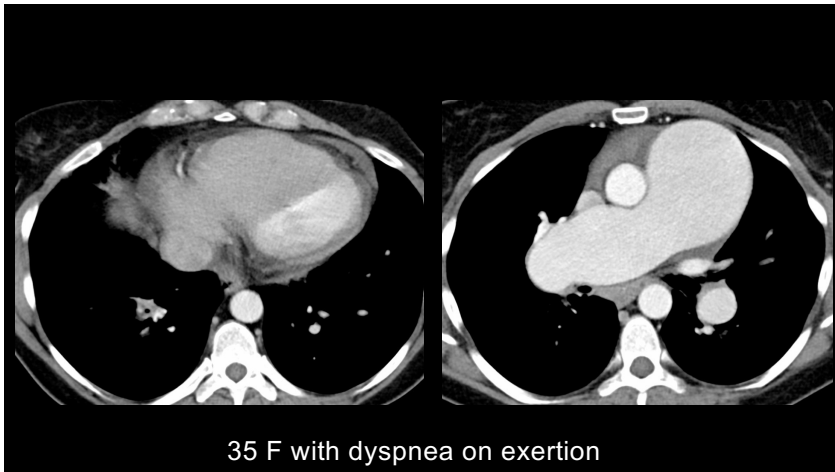


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35 F with dyspnea on exertion

12

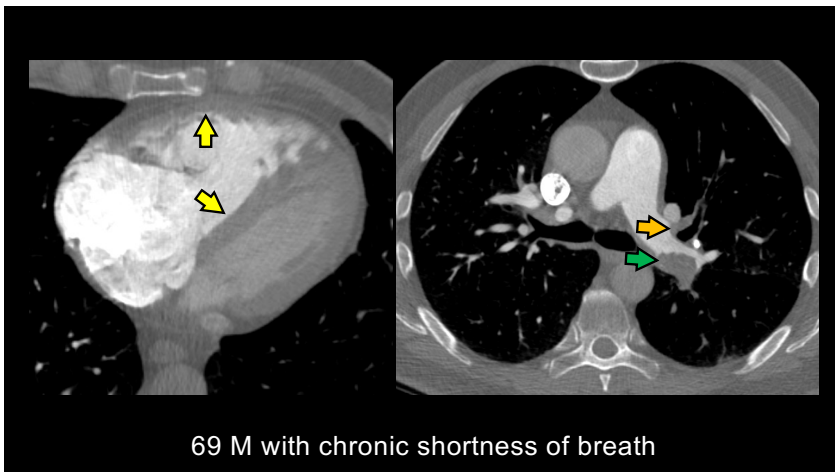


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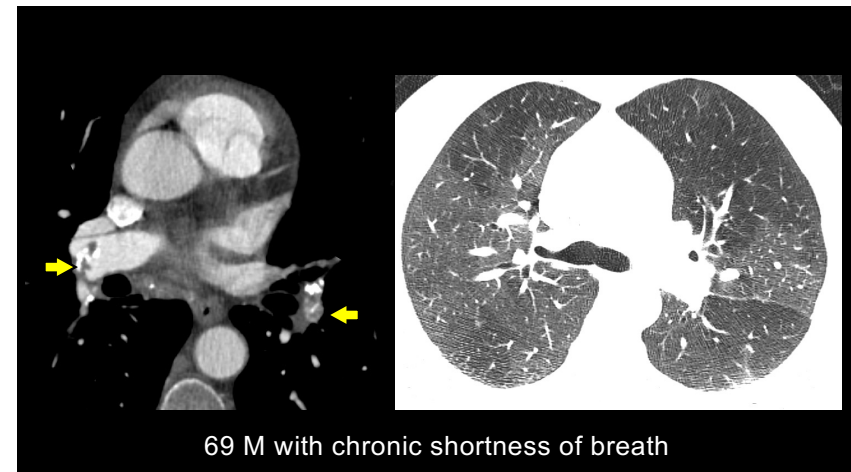
Idiopathic Pulmonary Hypertension

- Diagnosis of exclusion
 - Exclude CTEPH, left heart disease, etc.
- Genetic predisposition
 - BMP2 and others
- Decreased production of vasodilators and increased production of vasoconstrictors
- Leads to vasoconstriction, vascular remodeling, and thrombosis → increase in pulmonary vascular resistance

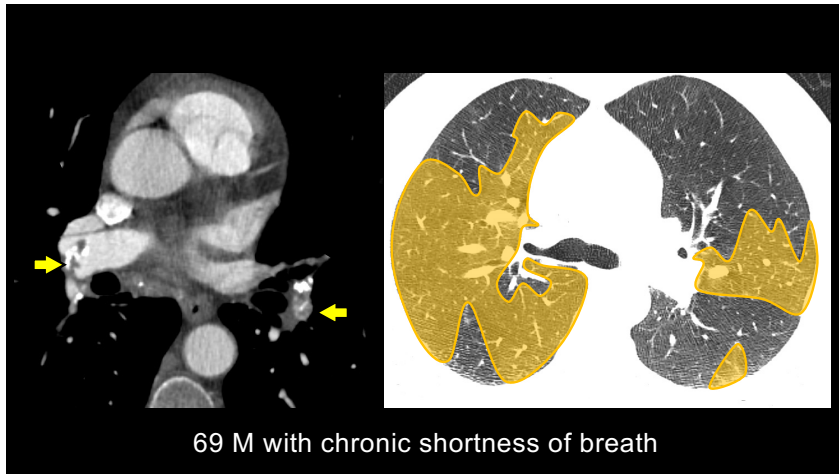
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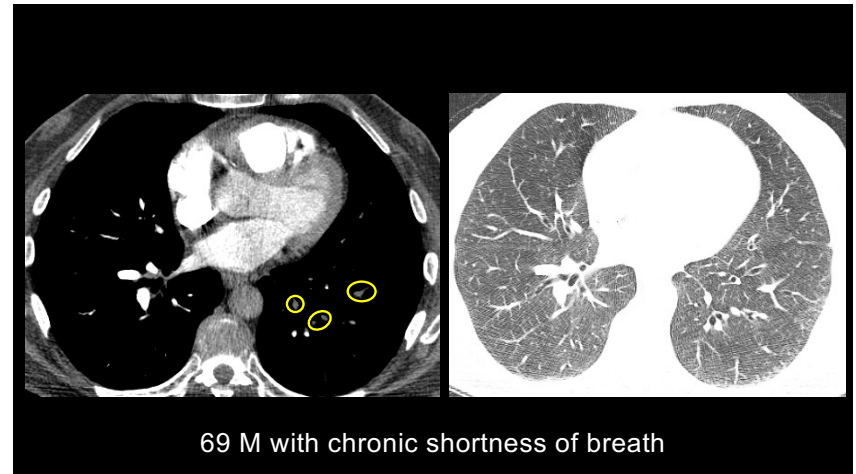


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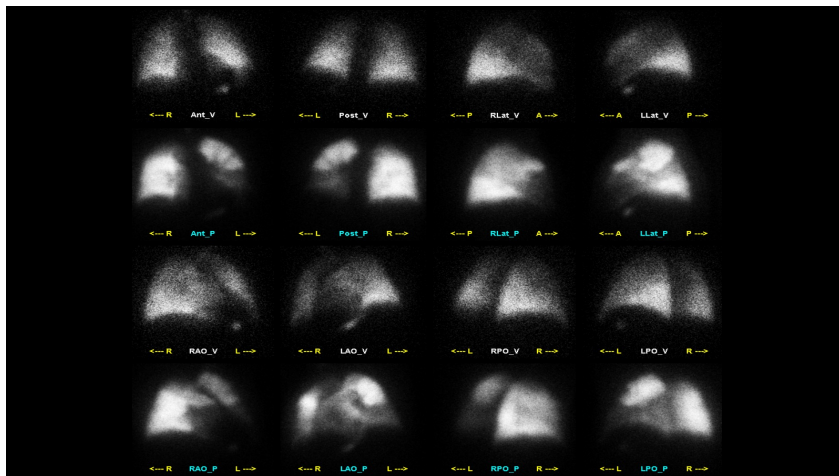
69 M with chronic shortness of breath

17



69 M with chronic shortness of breath

18



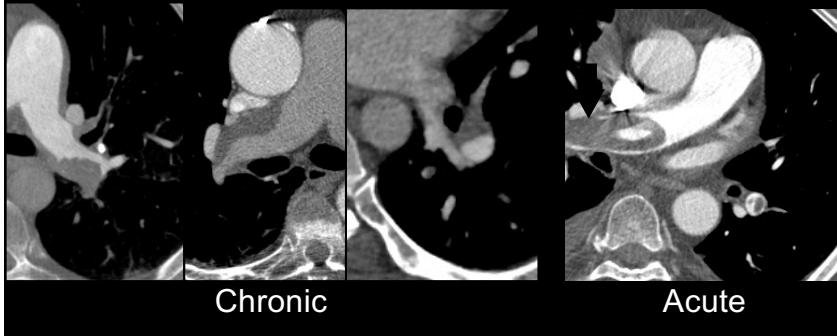
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Chronic Thromboembolic PH

- Important to distinguish from acute embolism
- Many findings of chronicity:
 - Thrombus location
 - Webs and calcifications
 - Decreased PA diameter / abrupt cut-off
 - Vessel size discrepancy in mosaic attenuation
 - Collateral vessels
 - RV hypertrophy

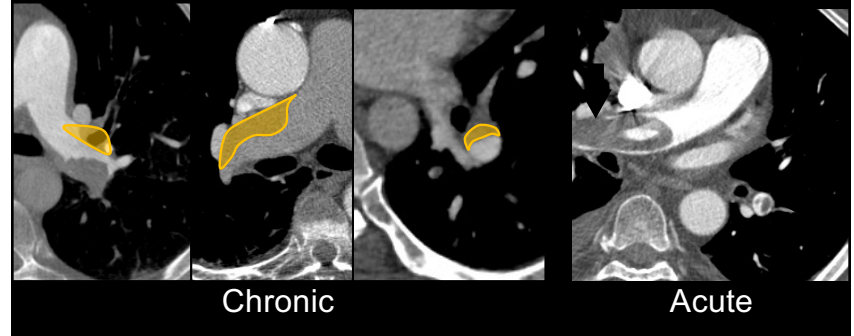
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Thrombus Location



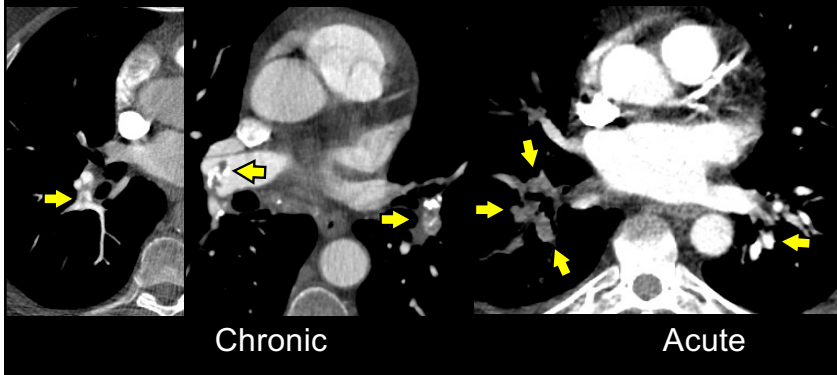
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Thrombus Location



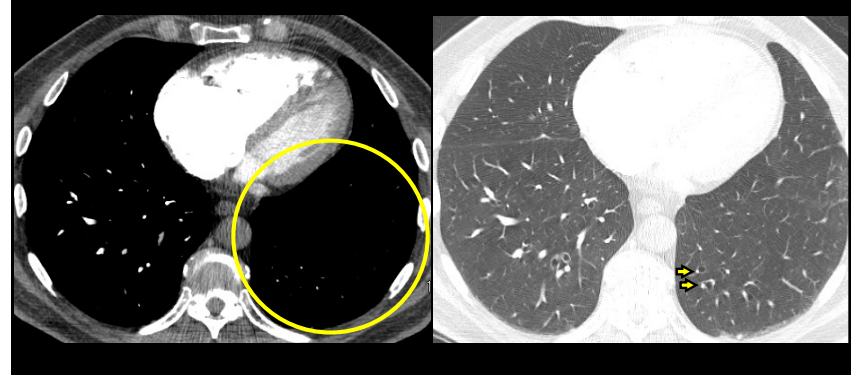
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Webs and Calcifications

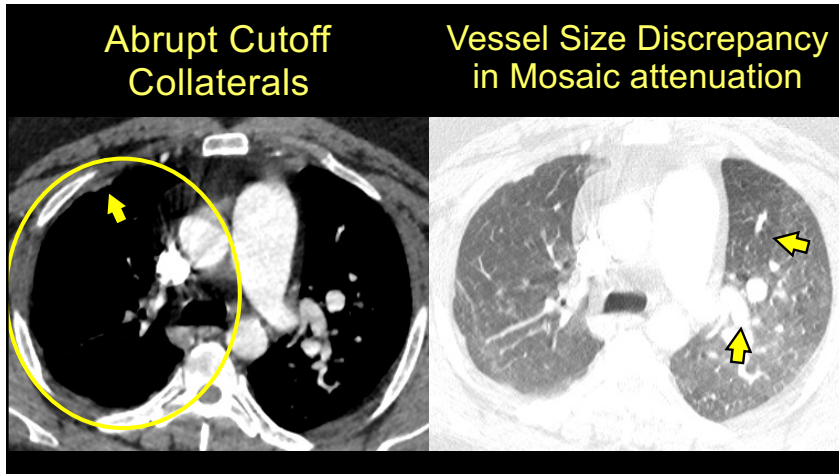


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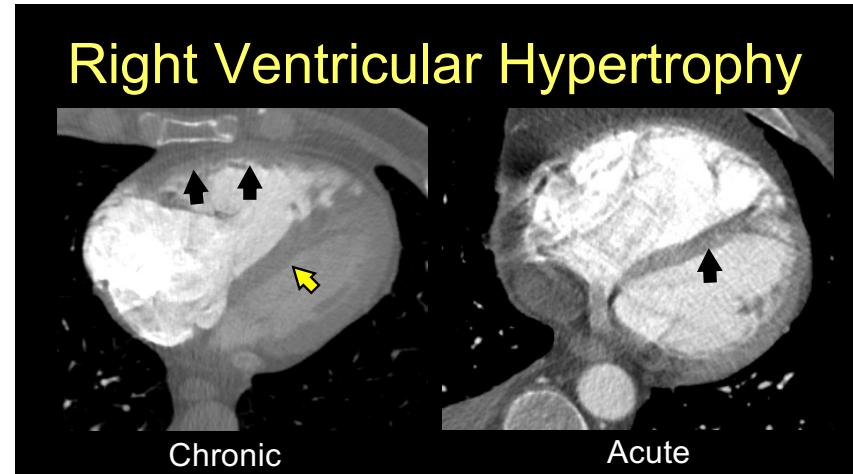
Decreased PA Caliber



24



25

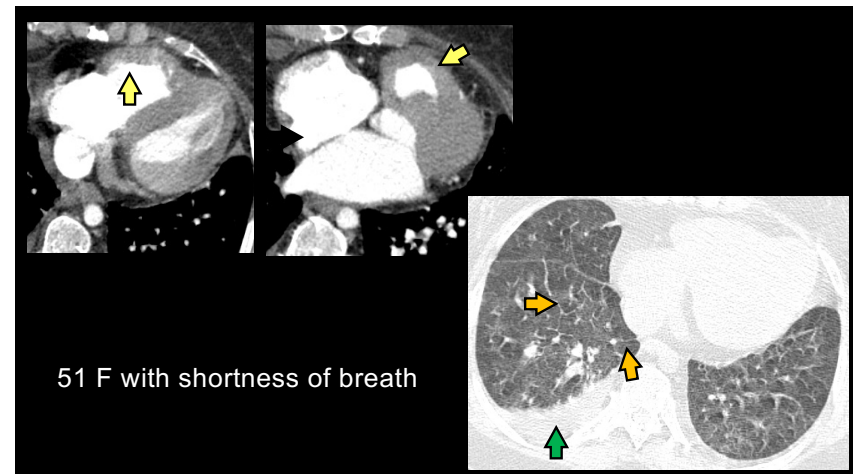


26

Key Points

- Many findings of chronicity, can be subtle, often not all present
- Vessel size discrepancy
- Symmetry
- Tapering versus dilated vessels
- Areas of mosaic attenuation

27



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Left Heart Disease

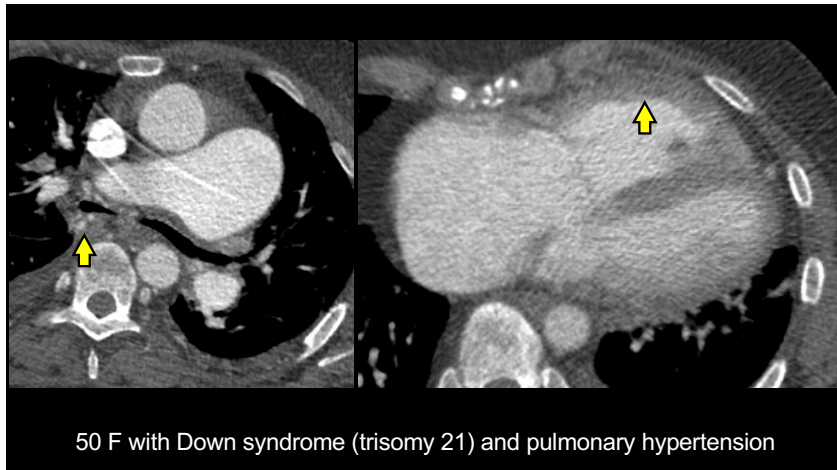
- One of the most common causes of pulmonary hypertension
- Diagnosis usually made by echocardiography and right heart catheterization
 - Reduced LV ejection fraction
 - Elevated LA wedge pressure
- PH can decrease with LV functional improvement

29

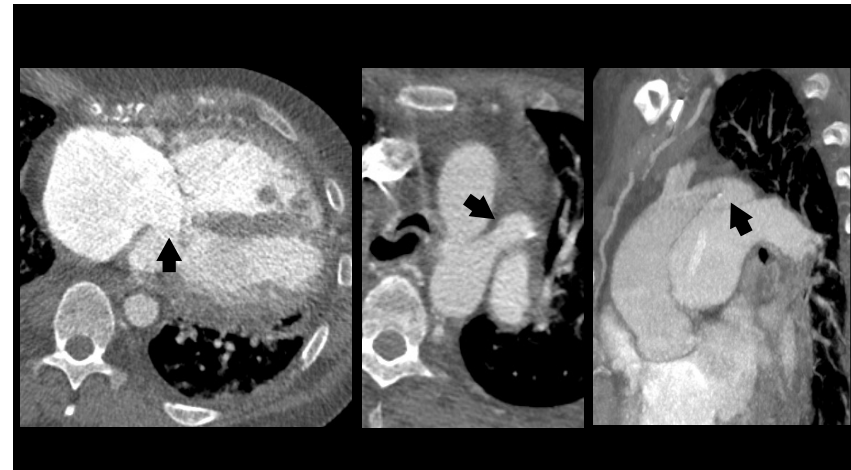
Key Points

- Left heart disease common
- Septal lines
 - Left heart disease most common cause
 - Left atrial size is small in PVOD and PCH

30



31



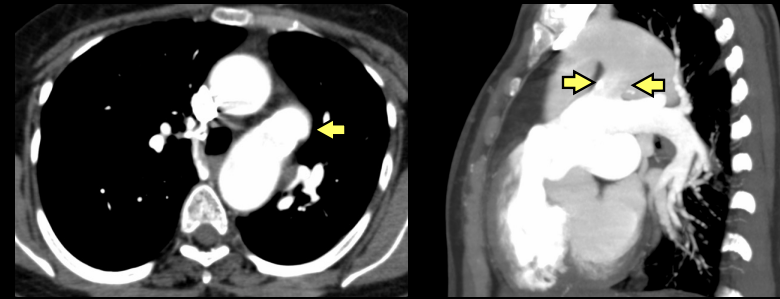
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Congenital Heart Disease

- Congenital heart disease with left-to-right shunts can lead to pulmonary hypertension
- Atrial septal defects most common
- Sometimes scimitar syndrome can lead to pulmonary hypertension

33

Another Example

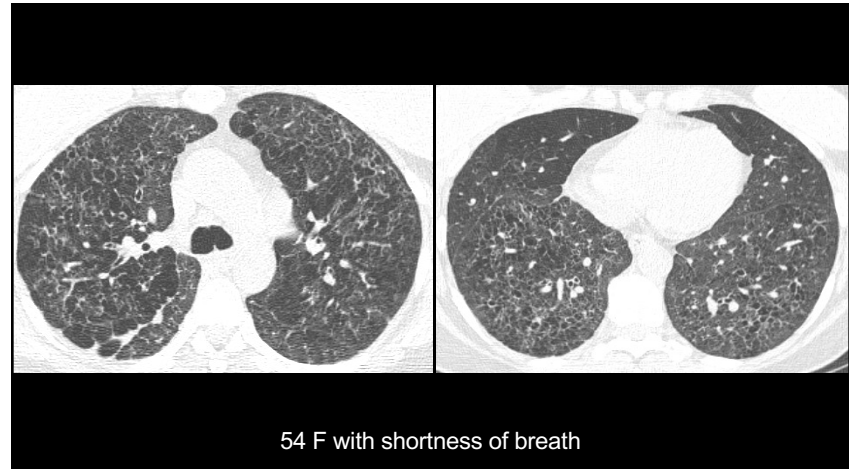


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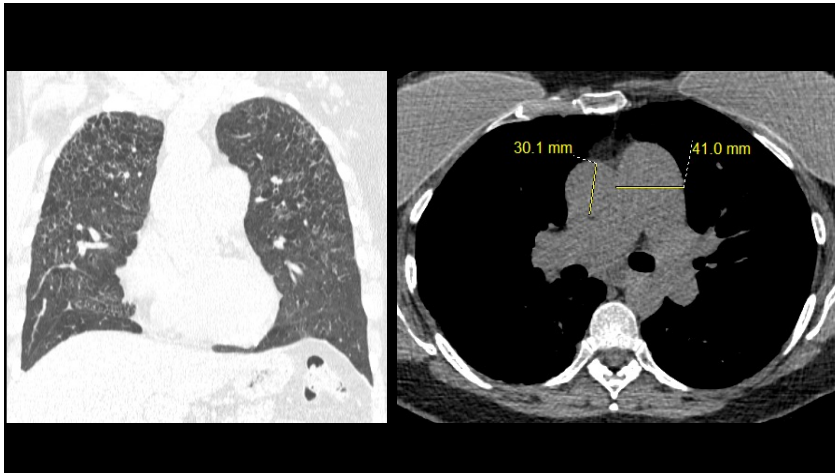
Key Points

- Congenital abnormalities on routine chest CT
- Cardiovascular CT and MRI for anatomical information
- Cardiac MRI and MRA for shunt quantification and cardiac function

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Pulmonary Langerhans Cell Histiocytosis

- Almost always smoking related
- Nodules → cysts → confluent spaces
- PH more common and more severe than with emphysema



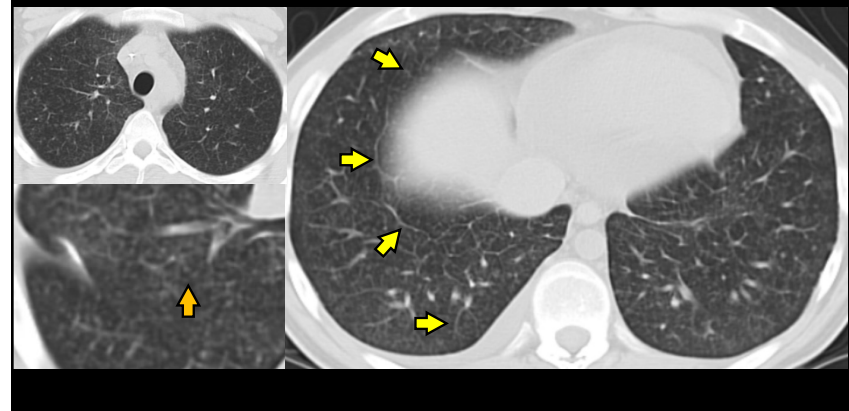
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Key Points

- Emphysema and cysts can coexist → walls
- Cyst shape and distribution
- LAM and emphysema can also cause pulmonary hypertension

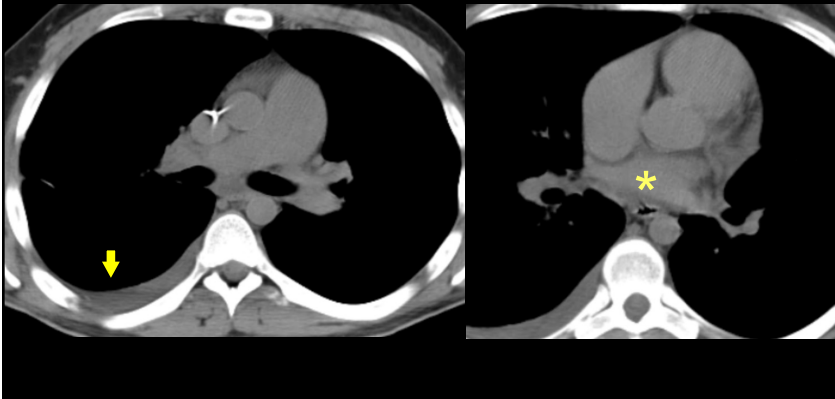
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42 F with newly diagnosed pulmonary hypertension



40

42 F with newly diagnosed pulmonary hypertension



41

Centrilobular Nodules

- Idiopathic PAH (treated) > new diagnosis
- PVOD or PCH
- Infectious or respiratory bronchiolitis
 - Not that diffuse
 - Do not cause acute pulmonary hypertension

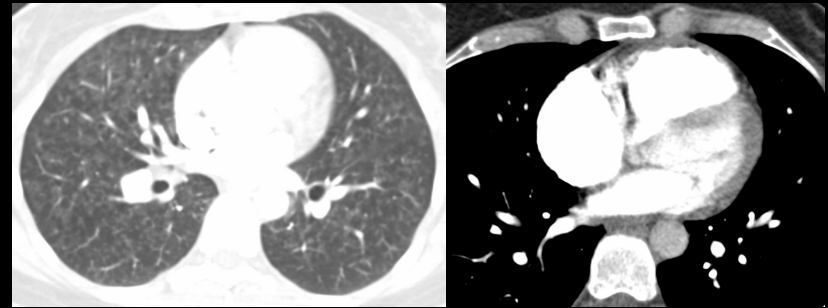
42

Pulmonary Capillary Hemangiomas (PCH)

- PVOD and PCH often misdiagnosed
- Clinical and radiologic features overlap with PVOD
- May be part of the same spectrum
- Rare diagnosis

43

Another Example

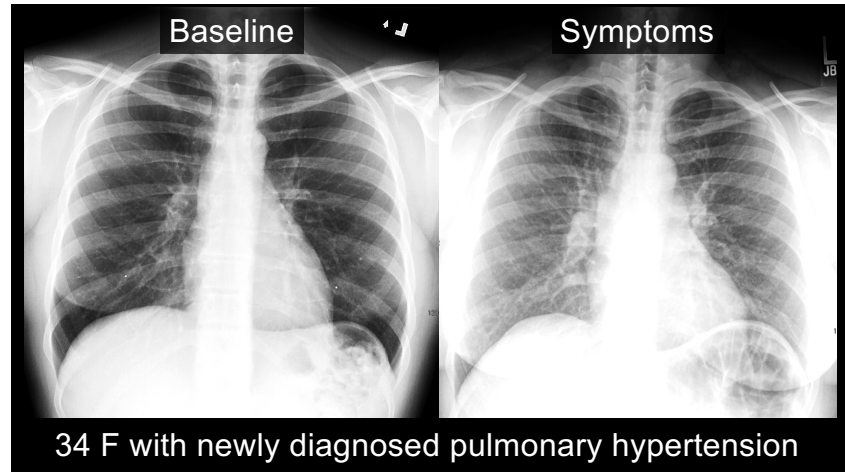


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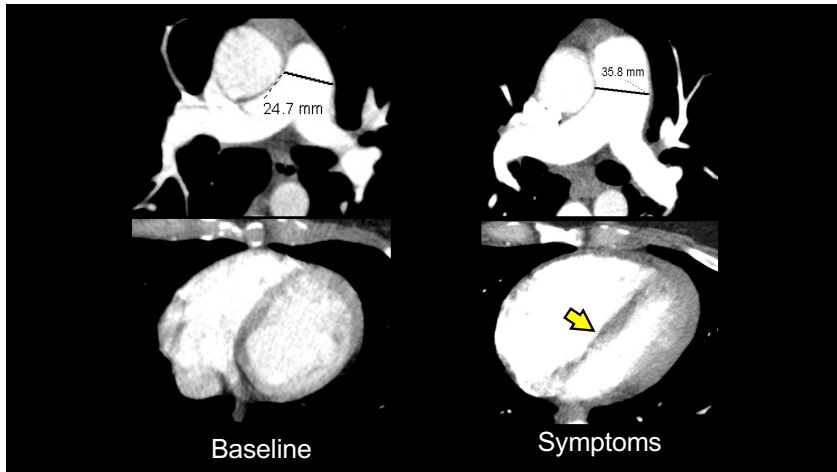
Key Points

- Both should be mentioned in DDx
- Centrilobular ground-glass nodules, well circumscribed, favor PCH over PVOD
- Fewer septal lines favors PCH over PVOD

45

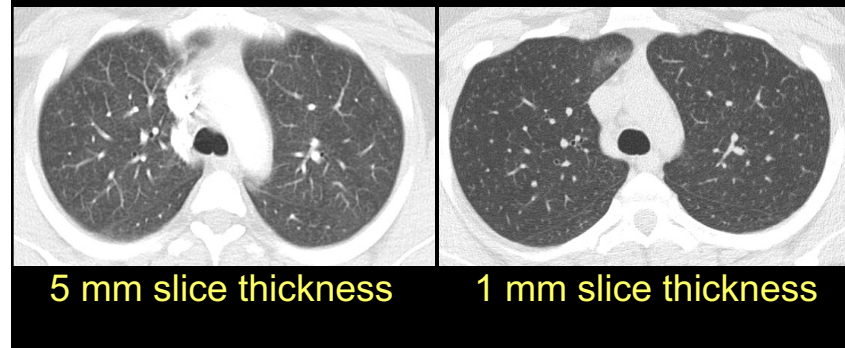


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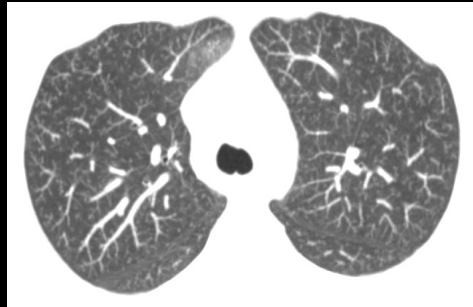
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Technique is Important



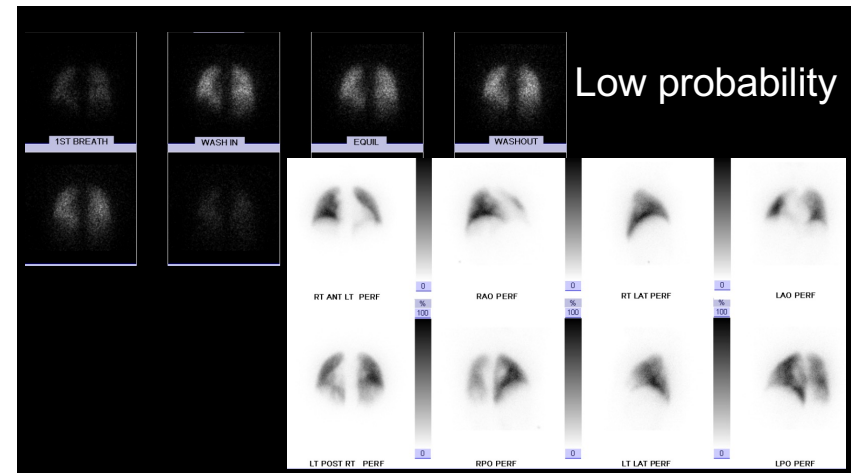
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Technique is Important

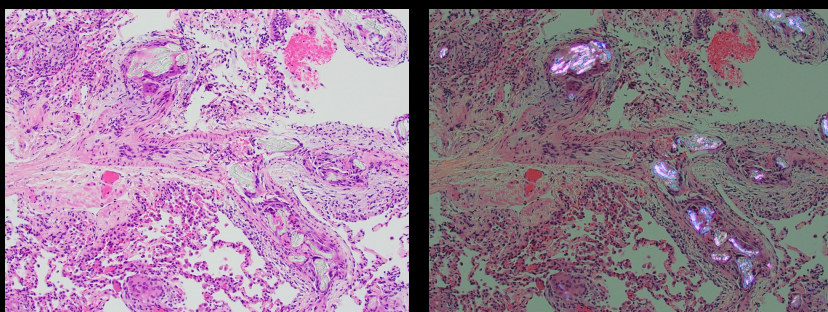


MIP

49



50



Intravascular foreign body-type granulomas and birefringent crystals suggestive of for talc emboli from injection

51

Excipient Lung Disease

- Tree-in-bud → granulomatous reaction to foreign material in vessel wall (talc, cellulose, starch)
- Delayed diagnosis

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Key Points

- High index of suspicion
- Consider in all cases of tree-in-bud nodules and acute right heart dysfunction

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Treatment

- Patients should be referred to expert PH center if able

The Alfred Hospital

55 Commercial Rd, Melbourne VIC 3004

Royal Children's Hospital

50 Flemington Rd, Parkville VIC 3052

Austin Hospital

145 Studley Rd, Heidelberg VIC 3084

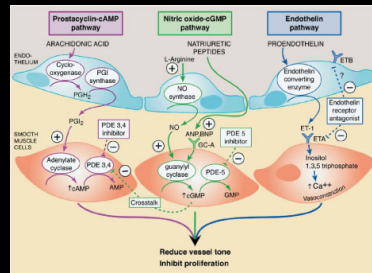
Royal Melbourne Hospital

300 Grattan Street (corner of Royal Parade)
Parkville, Victoria 3050
Australia

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Treatment

- Manage underlying cause(s)
- Medications
- Surgical procedures
- Transplant



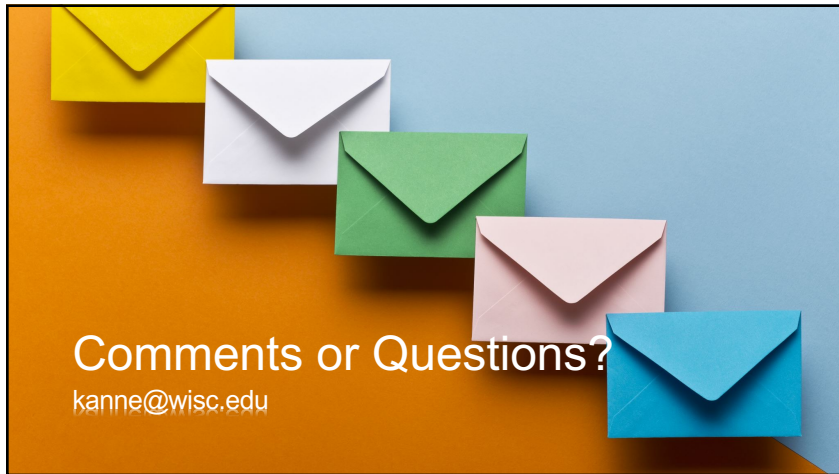
thecardiologyadvisor.com

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Summary

- Pulmonary hypertension has many causes
- Diagnosis can be challenging
- Clues on chest CT may suggest or indicate the underlying cause

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