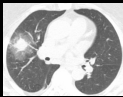



# Spectrum of Pulmonary Aspergillosis

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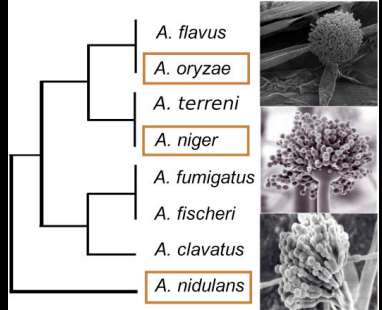
**CHESTRAD 2023**

A Case Review and Lecture Series  
Saturday 15<sup>th</sup> July - Sunday 16<sup>th</sup> July - Monday 17<sup>th</sup> July  
27 CPD Points

1

# Introduction

- *Aspergillus* is a genus of ubiquitous soil fungi
- Pulmonary aspergillosis occurs primarily in immunocompromised patients



*Infectious Diseases* (Fourth Edition), 2017

2

# Objectives

- Define the spectrum of pulmonary aspergillosis
- Establish the clinical contexts in which various manifestations of pulmonary aspergillosis are encountered
- Illustrate imaging findings of pulmonary aspergillosis with a focus on CT

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# Spectrum of Aspergillosis

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# ABPA

- Complex hypersensitivity reaction to *Aspergillus* growing in the airways
- IgE and IgG immune complexes and eosinophils cause airway wall damage
- Thick mucus plugs can form
- Nearly all patients have asthma or cystic fibrosis

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# ABPA

International Society for Human and Animal Mycology (ISHAM) working group diagnostic criteria for allergic bronchopulmonary aspergillosis

<b>Predisposing conditions (one must be present)*:</b>
Asthma
Cystic fibrosis
<b>Obligatory criteria (both must be present):</b>
Serum IgE levels against <i>Aspergillus fumigatus</i> (>0.35 kU/L) or <i>Aspergillus</i> skin test positivity
Elevated total IgE concentration (typically >1000 IU/mL, but if the patient meets all other criteria, an IgE value <1000 IU/mL may be acceptable, especially if <i>A. fumigatus</i> -specific IgE levels are >27 mg/L)
<b>Other criteria (at least two must be present):</b>
Precipitating serum antibodies to <i>A. fumigatus</i> or elevated serum <i>Aspergillus</i> IgG by immunoassay (>27 mg/L)
Radiographic pulmonary opacities consistent with ABPA ←
Total eosinophil count >500 cells/microl, in glucocorticoid-naïve patients (may be historical)

IgE: immunoglobulin E; ABPA: Allergic bronchopulmonary aspergillosis.  
 \* Rarely, ABPA is identified in the absence of asthma or cystic fibrosis, COPD and post-tuberculous fibrocavitary disease may be predisposing conditions.

References:  
 1. Agarwal R, Chakrabarti A, Shah A, et al. Allergic bronchopulmonary aspergillosis: review of literature and proposal of new diagnostic and classification criteria. Clin Exp Allergy 2013; 43:850.  
 2. Agarwal R, Sahgal JS, Choudhri S, Agarwal AN. Developments in the diagnosis and treatment of allergic bronchopulmonary aspergillosis. Expert Rev Respir Med 2016; 10:1317

UpToDate - accessed June 2023

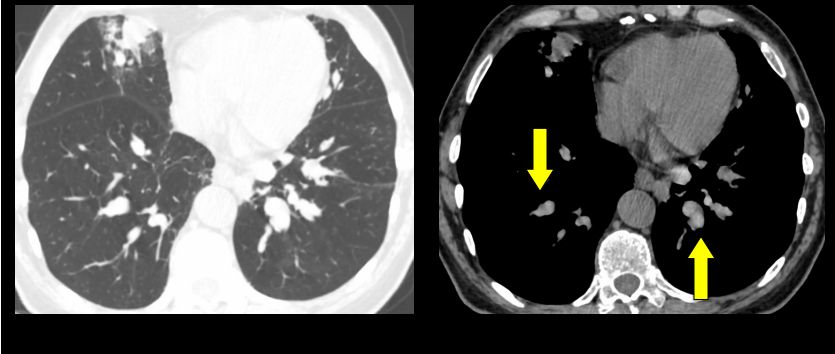
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# ABPA

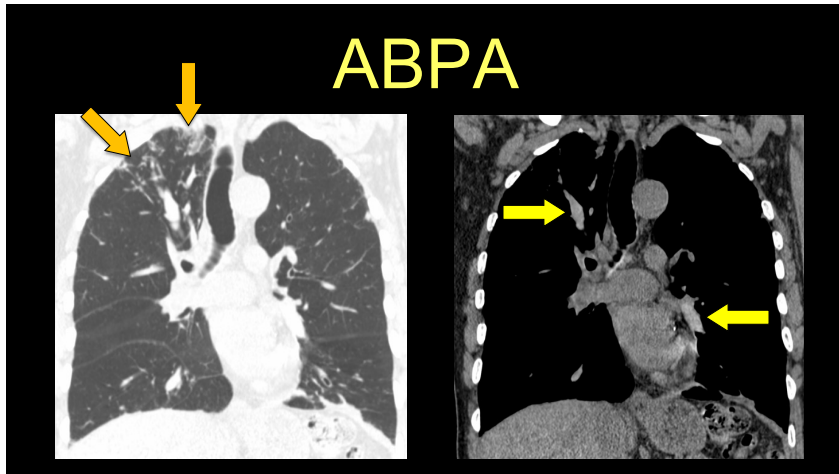
- “Finger in glove” appearance on chest radiography
- Bronchiectasis and mucus plugs primarily in the segmental and subsegmental upper lobe bronchi
- High attenuation mucus plugs ~30%
- Associated atelectasis

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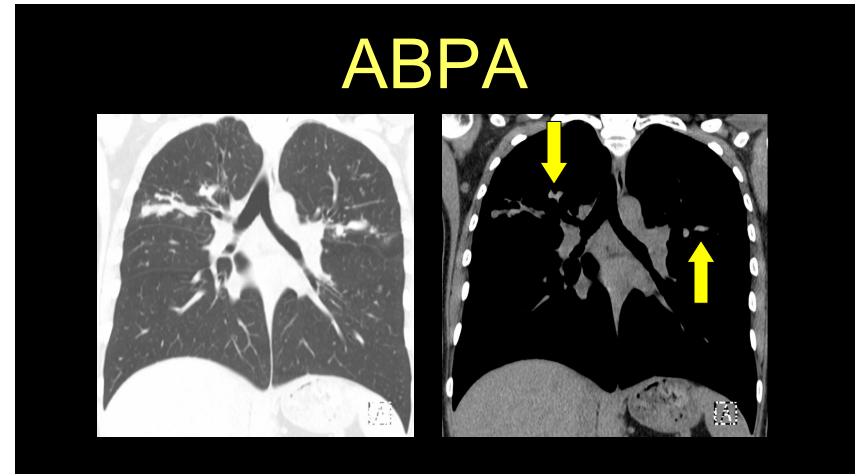
# ABPA



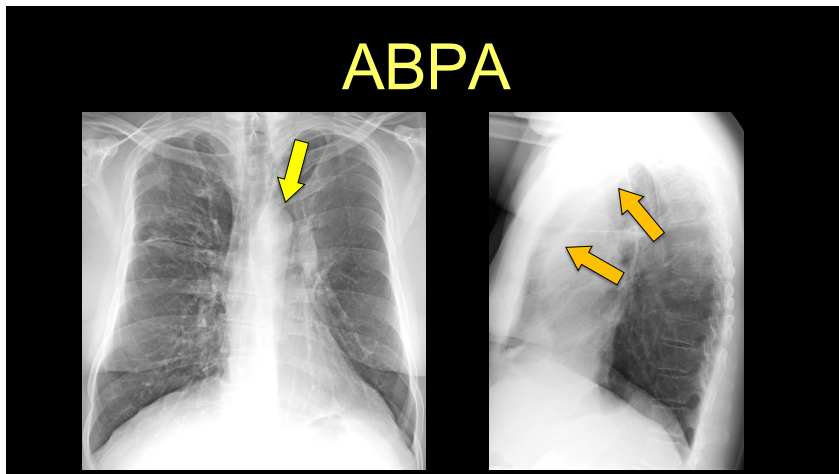
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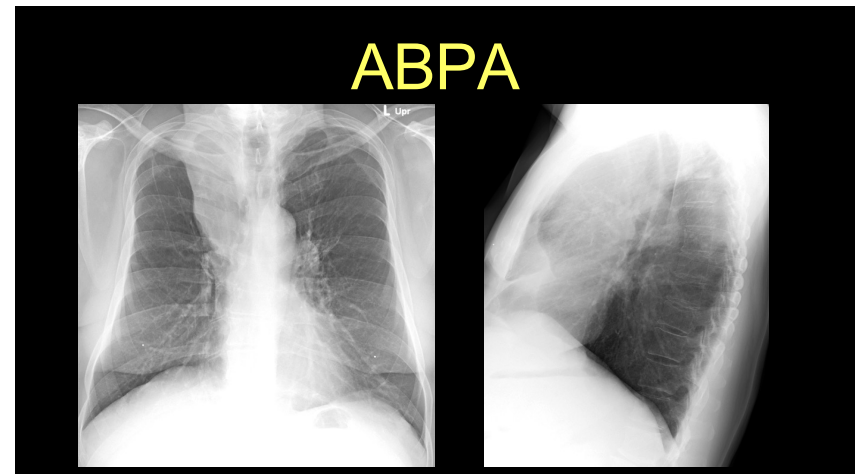
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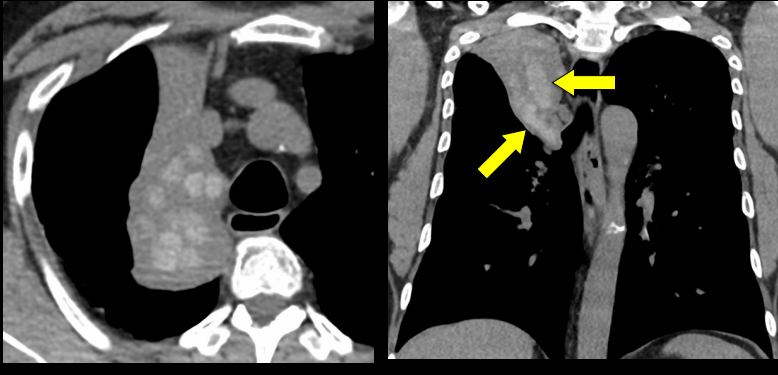


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## ABPA



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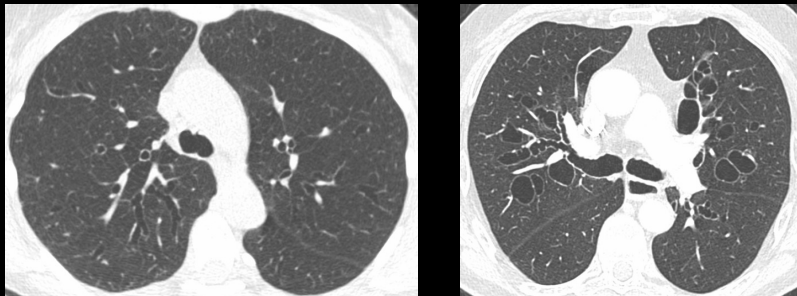
## ABPA - DDx

- Cystic fibrosis
- Williams-Campbell syndrome
- Alpha-1 antitrypsin deficiency
- Obstructing neoplasm

🔑 High attenuation mucus plugs ~pathognomonic for ABPA

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## ABPA - DDx



Alpha-1 antitrypsin deficiency

Williams-Campbell syndrome

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## Aspergilloma

- Saprophytic growth of *Aspergillus* in a pre-existing cavity or cystic space
- Associated tissue reaction
- Hemoptysis most common clinical manifestation
- Resection is definitive therapy
- Embolization for acute hemoptysis

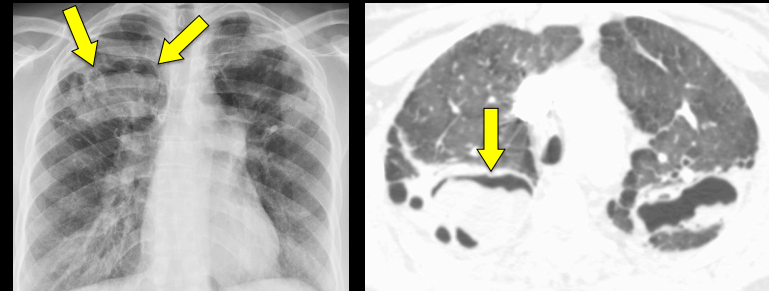
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# Aspergilloma

- Heterogenous mass usually layering dependently in cavity
- Monod sign
- Thickening of cavity wall
- Thickening of adjacent pleura and extrapleural fat
- Hypertrophy of supplying vessels

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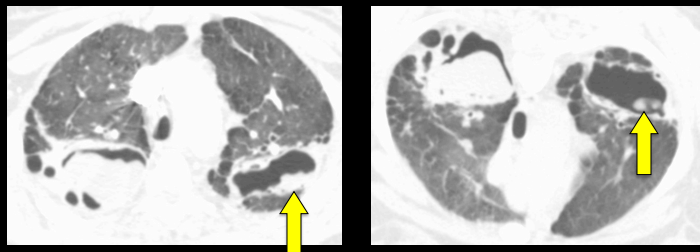
# Aspergilloma



🔑 Monod sign *not* the same as air crescent sign

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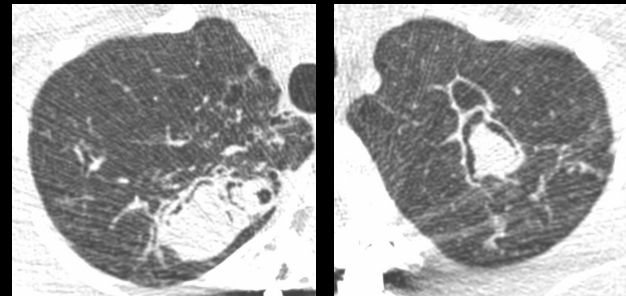
# Aspergilloma



🔑 Mobile intracavitary body favors aspergilloma over necrotic lung

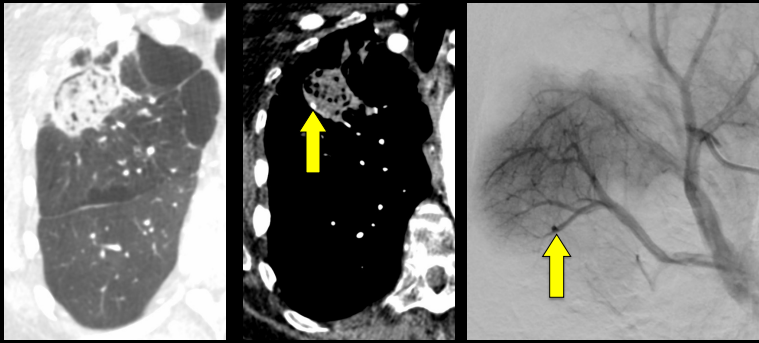
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# Aspergilloma



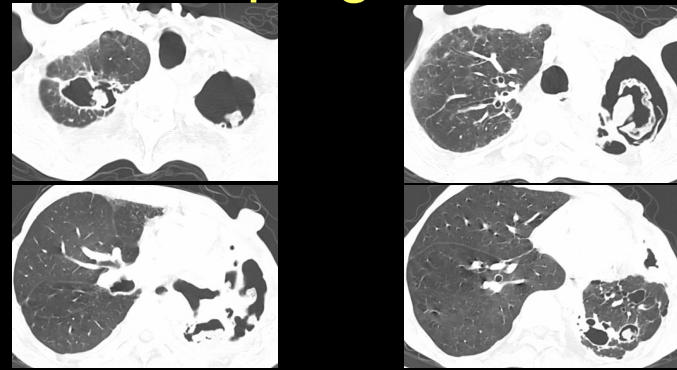
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## Aspergilloma



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## Aspergilloma



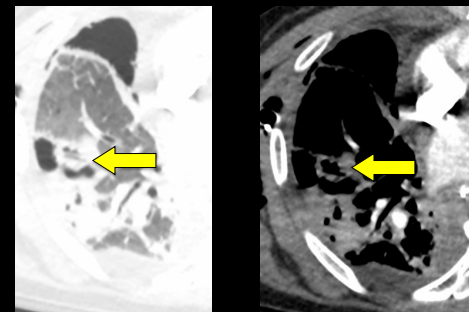
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## Aspergilloma - DDx

- Sloughed, necrotic lung in cavity
- Neoplasm
- Intracavitary hemorrhage

23

## Aspergilloma - DDx



*Clostridium* infection

24

## Subacute Invasive Aspergillosis

- Characterized by tissue necrosis and granulomatous inflammation
- Chronic diseases are risk factors including COPD, diabetes, malnutrition, alcohol abuse
- Other risk factors – advanced age and chronic corticosteroids
- Insidious onset of symptoms and can mimic post-primary tuberculosis, actinomycosis, and chronic histoplasmosis

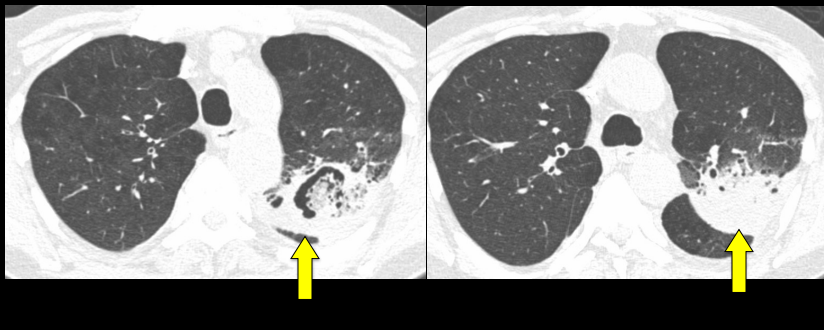
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## Subacute Invasive Aspergillosis

- Variable consolidation
- Cavities (+/-)
- Smaller nodules
- Thickening of adjacent pleura
- Slow progression

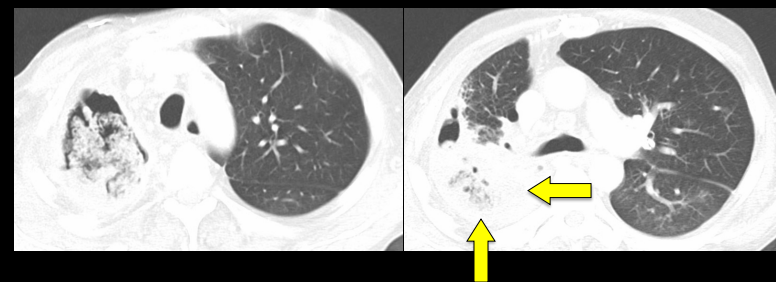
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## Subacute Invasive Aspergillosis



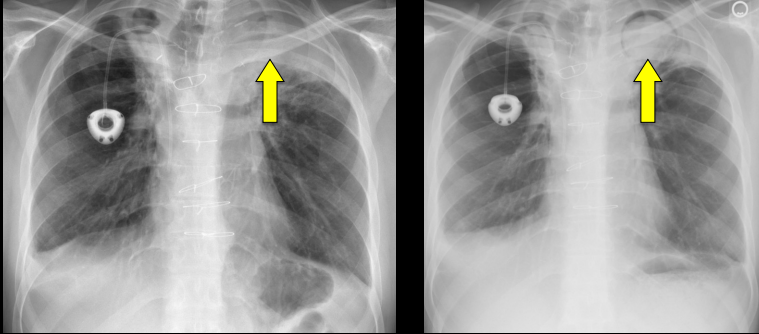
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## Subacute Invasive Aspergillosis



28

## Subacute Invasive Aspergillosis



29

## Subacute Invasive Aspergillosis



30

## Airways Invasive Aspergillosis

- Most commonly occurs in neutropenic patients and patients with AIDS
- Clinical manifestations
  - Acute tracheobronchitis
  - Bronchiolitis
  - Bronchopneumonia

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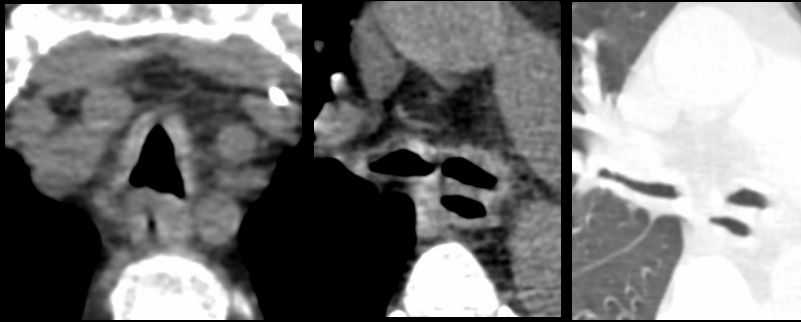
## Airways Invasive Aspergillosis

- Acute tracheobronchitis
  - Normal to mild airway wall thickening
- Acute bronchiolitis
  - Centrilobular nodules (round or branching)
- Bronchopneumonia
  - Peribronchial nodules
  - Peribronchial consolidation
- Endobronchial aspergillosis - rare

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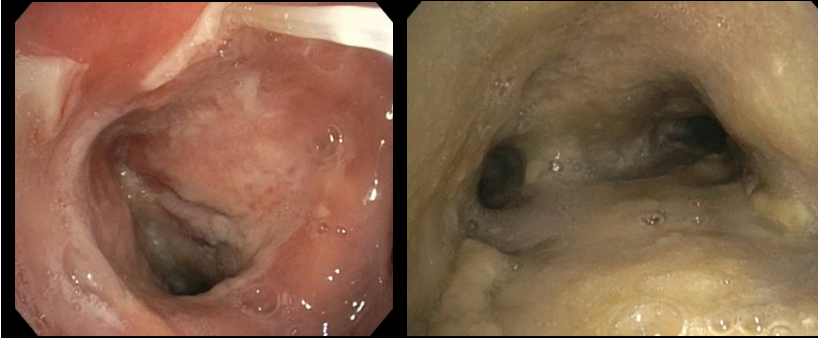


## Tracheobronchitis



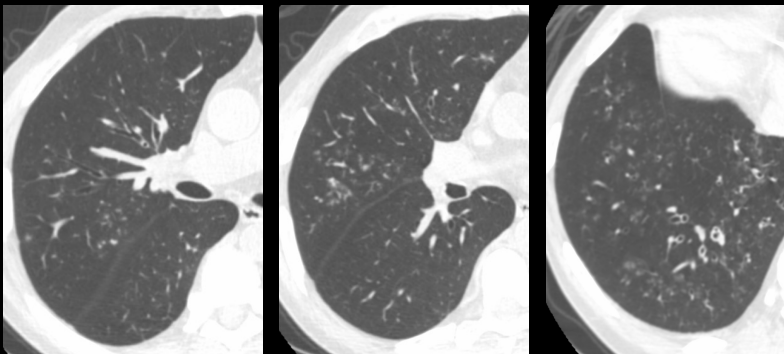
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## Tracheobronchitis



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## Bronchiolitis



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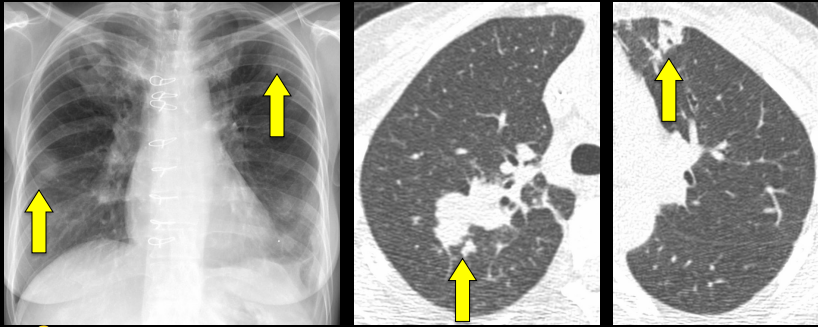
## Bronchopneumonia



🔑 Indistinguishable from other causes of infection

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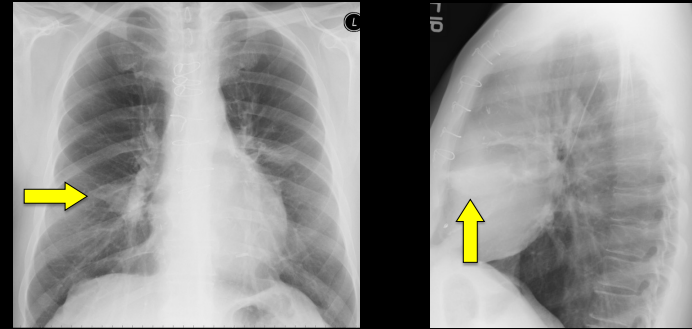
## Bronchopneumonia



Consider aspergillosis if patient adequately immunosuppressed

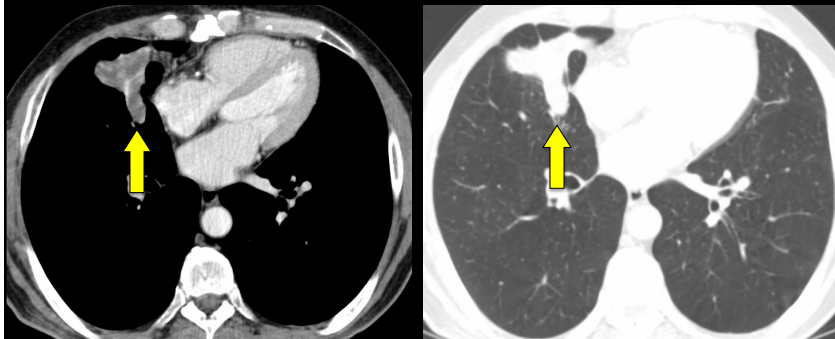
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## Endobronchial Aspergillosis



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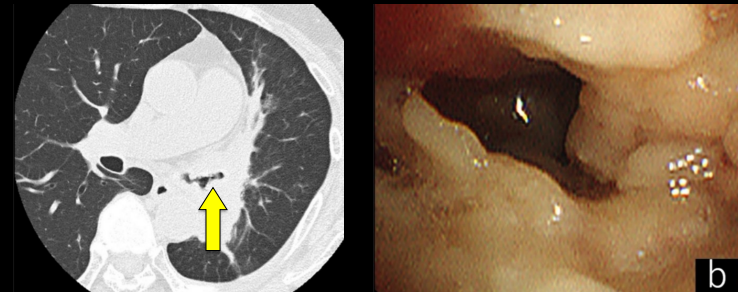
## Endobronchial Aspergillosis



Lacks high attenuation mucus plugs of ABPA

39

## Endobronchial Aspergillosis



Tsuneoka Y et al. *BMC Pulm Med* in press

40

## Angioinvasive Aspergillosis

- Most commonly occurs in severely neutropenic patients
- High dose corticosteroids can impair neutrophil function
- Voriconazole prophylaxis has reduced incidence, especially in neutropenic patients
- Graft-versus-host disease is an additional risk factor, especially when voriconazole is stopped

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## Angioinvasive Aspergillosis

- CT halo sign – nodule(s) surrounded by ground-glass opacity
- Peripheral wedge-shaped foci of consolidation reflecting septic infarcts

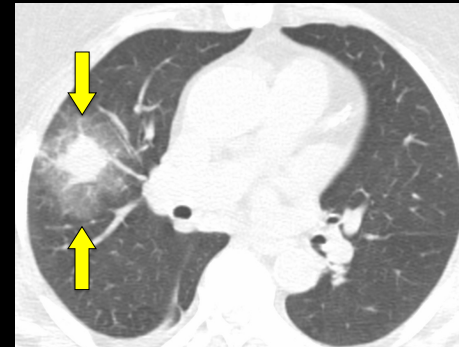
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## Angioinvasive Aspergillosis



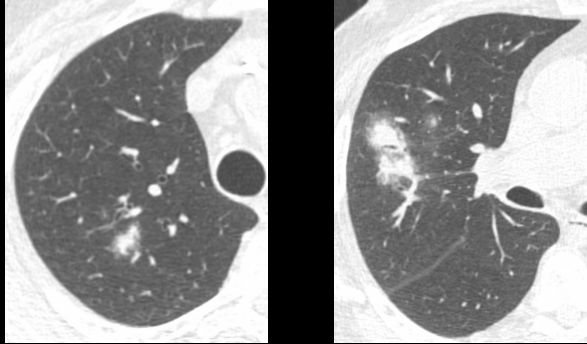
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## Angioinvasive Aspergillosis



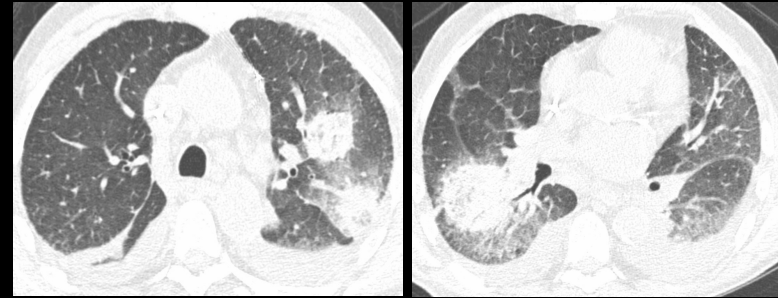
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## Angioinvasive Aspergillosis



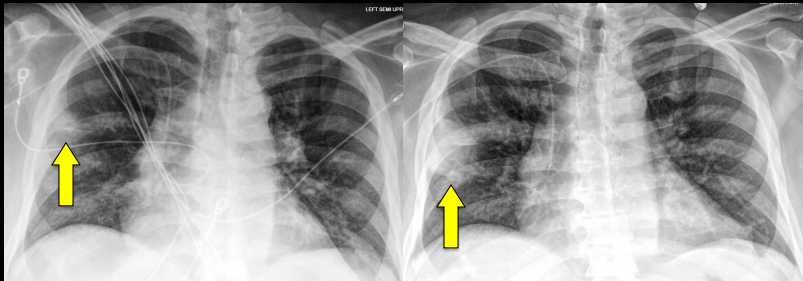
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## Angioinvasive Aspergillosis



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## Angioinvasive Aspergillosis



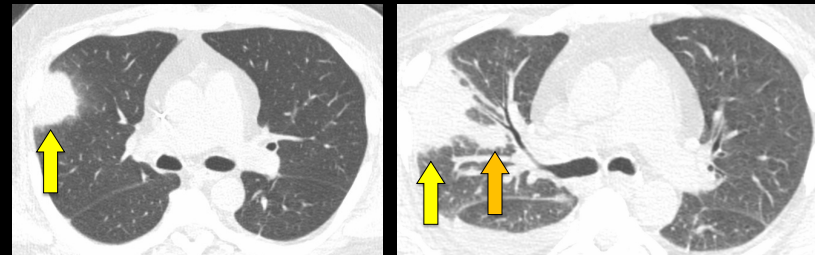
Presentation

12 days later

🔑 Progression depends on degree of immunosuppression

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## Angioinvasive Aspergillosis

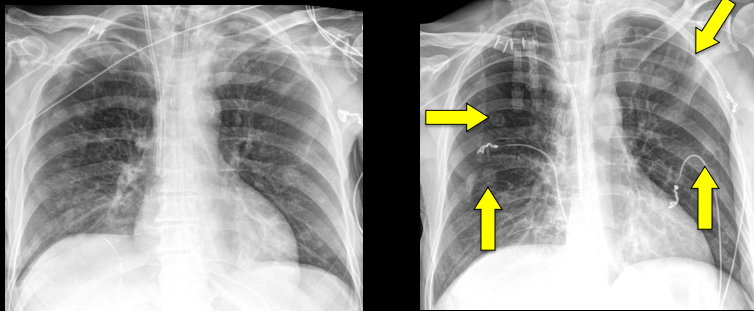


Presentation

12 days later

48

## Angioinvasive Aspergillosis

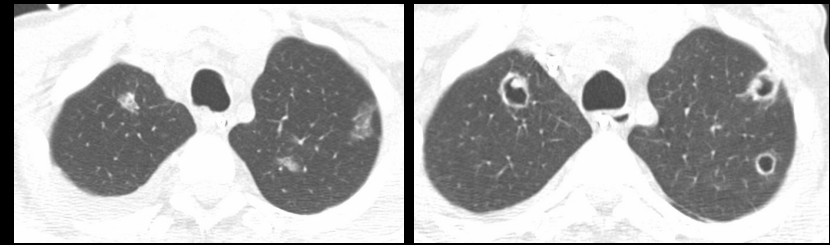


Presentation

6 days later

49

## Angioinvasive Aspergillosis

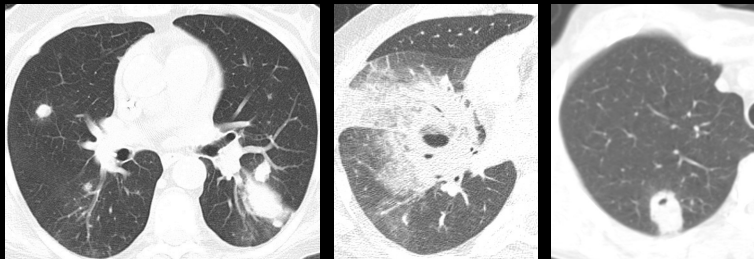


Presentation

6 days later

50

## Angioinvasive Aspergillosis - DDx



Nocardiosis

Mucor

Cryptococcosis

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## Summary

- Aspergillosis is primarily an opportunistic infection in the lungs
- Noninvasive infection can occur in patients with structural lung disease
- ABPA primarily develops in patients with asthma and cystic fibrosis

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