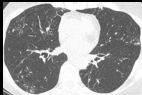



Nontuberculous Mycobacterial Infection

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

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Introduction

- ~200 species of nontuberculous mycobacteria (NTM) have been identified
- ~140 are pathogenic to humans and animals
- Opportunistic organisms residing in soil, water, and other environmental reservoirs

Nontuberculous Mycobacterial Infections

Field guide, 10th, Nat. M. Series, 2017

KEY POINTS

- Pathogenic nontuberculous mycobacteria (NTM) are widely distributed in the environment and are ubiquitous in the air without undergoing any special life cycle stage.
- The most commonly reported NTM diseases in humans are caused by *M. avium* complex, *M. abscessus*, and *M. fortuitum*.
- The *M. avium* complex is a group of mycobacteria that includes *M. avium*, *M. intracellulare*, and *M. abscessus*.
- *M. abscessus* is a rapidly growing mycobacterium that is commonly found in soil, water, and air.
- *M. fortuitum* is a rapidly growing mycobacterium that is commonly found in soil, water, and air.

INTRODUCTION

Approximately 200 species of nontuberculous mycobacteria (NTM) are widely distributed in the environment and are ubiquitous in the air without undergoing any special life cycle stage. The most commonly reported NTM diseases in humans are caused by *M. avium* complex, *M. abscessus*, and *M. fortuitum*. The *M. avium* complex is a group of mycobacteria that includes *M. avium*, *M. intracellulare*, and *M. abscessus*. *M. abscessus* is a rapidly growing mycobacterium that is commonly found in soil, water, and air. *M. fortuitum* is a rapidly growing mycobacterium that is commonly found in soil, water, and air.


Etiology and Sources of Infection

NTM are ubiquitous in the environment and are found in soil, water, and air. They are commonly found in soil, water, and air. They are commonly found in soil, water, and air.

Diagnosis and Treatment

NTM infections are diagnosed by culture of clinical specimens. Treatment is typically long-term and involves the use of multiple antibiotics.

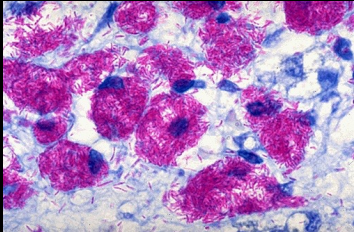
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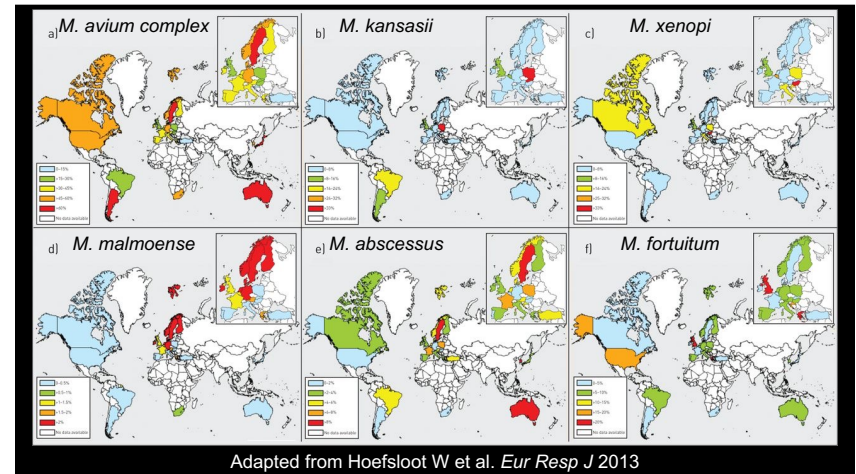
Introduction

- Increasing NTM infections in the developed and developing world
 - Increased life expectancy
 - Increased number of immunocompromised patients
 - Improved diagnostic techniques



PathologyOutlines.com

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Introduction

- Lung manifestations in 80%-90% of NTM infections
- Factors include
 - Immune status
 - Structural lung disease
 - Ethnicity
 - Geography

5

Objectives

- Review the diagnostic criteria for nontuberculous mycobacterial infection
- Illustrate imaging findings of NTM infection
- List differential diagnostic considerations

6

Diagnostic Criteria

- Clinical and radiologic criteria (all required)
 - Pulmonary symptoms
 - Nodular or cavitary opacities on chest radiograph or bronchiectasis with multiple small nodules on CT
 - Appropriate exclusion of other diagnoses

Daley CL et al. *Clin Infect Dis* 2020

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Diagnostic Criteria

- Microbiologic criteria
 - Positive culture from at least two separate sputum samples. If results are nondiagnostic, consider repeat sputum AFB smears and cultures *OR*
 - Positive culture result from at least one bronchial wash or lavage (regardless of AFB smear result) *OR*

Daley CL et al. *Clin Infect Dis* 2020

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Diagnostic Criteria

- Microbiologic criteria
 - Transbronchial or other lung biopsy with mycobacterial histopathologic features (granulomatous inflammation or AFB) *AND* positive culture for NTM; *OR*
 - Biopsy showing mycobacterial histopathologic features (granulomatous inflammation or AFB) *AND* one or more sputum or bronchial washings that are culture positive for NTM

Daley CL et al. *Clin Infect Dis* 2020

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Clinical Syndromes

- Cavitory (classical)
- Nodular bronchiectatic type
- Solitary lung nodule
- Hypersensitivity pneumonitis
- Disseminated disease

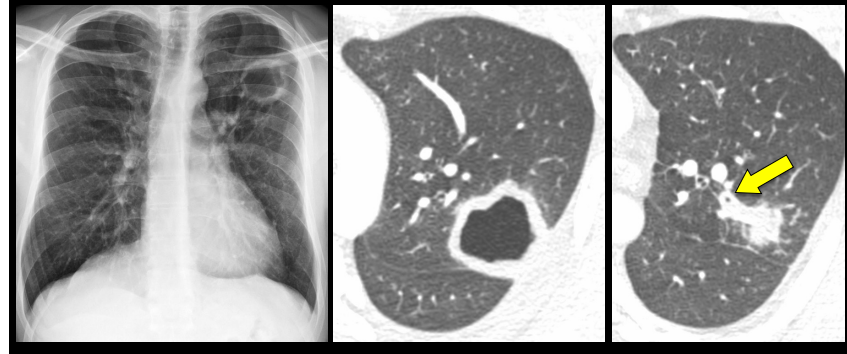
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Cavitory

- Referred to as “classical” pattern
- M>F, older, underlying lung disease (COPD)
- *M. avium* complex most common
- *M. kansasii* and *M. abscessus*
- Mimics tuberculosis clinically and on imaging

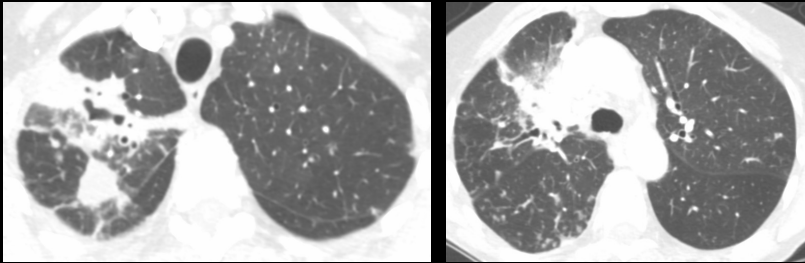
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Cavitory



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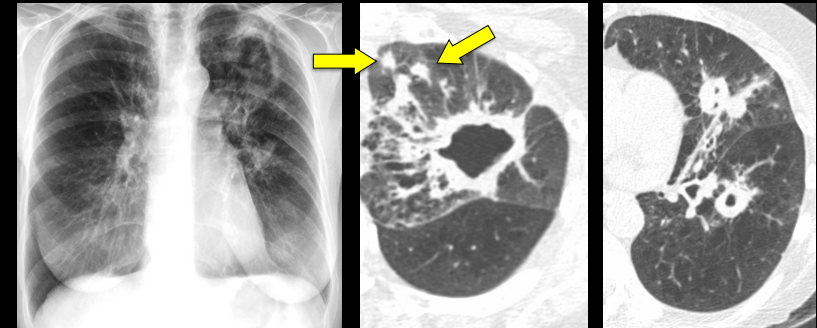
Cavitary



🔑 Pleural effusion and lymphadenopathy uncommon

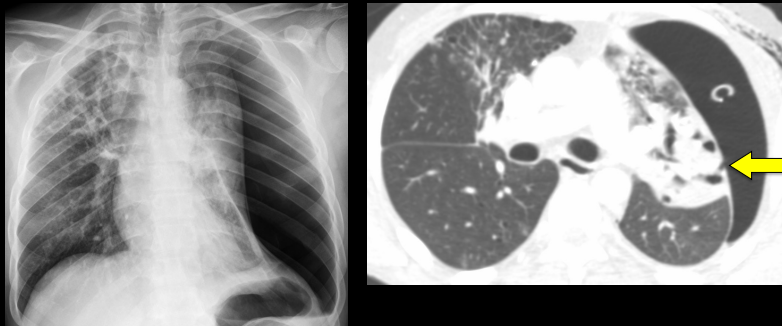
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Cavitary



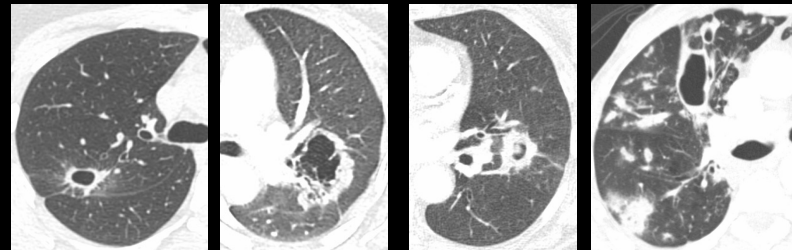
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Cavitary



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Differential Diagnosis



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Nodular Bronchiectatic

- Most common pattern in North America
- F>>M, middle age and elderly, White, nonsmoker
- *M. avium* complex and *M. kansasii* most common
- *M. chelonae* and *M. abscessus*
- Higher prevalence of CFTR gene mutations even without clinical cystic fibrosis¹

¹Jang MA. *J Hum Genet* 2013

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Nodular Bronchiectatic

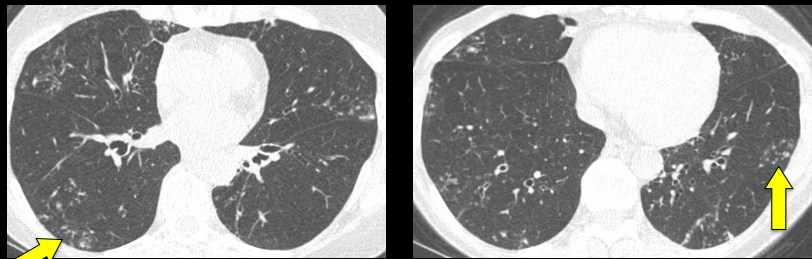
- Lady Windermere syndrome
 - Coined in 1992 by Reich and Johnson¹
 - Theorized cough suppression led to poor clearance of middle lobe and subsequent NTM infection
 - No supporting data
 - Patients with neuromuscular disease and poor cough no more susceptible to NTM infection²



¹Reich JM, Johnson RE. *Chest* 1992
²Rubn BK. *Chest* 2006

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Nodular Bronchiectatic



🔑 Tree-in-bud away from bronchiectasis suggestive of active disease

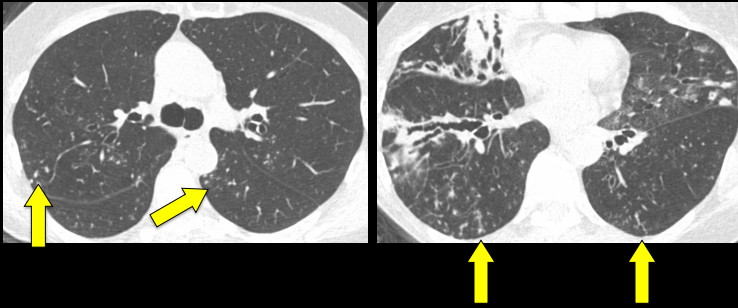
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Nodular Bronchiectatic



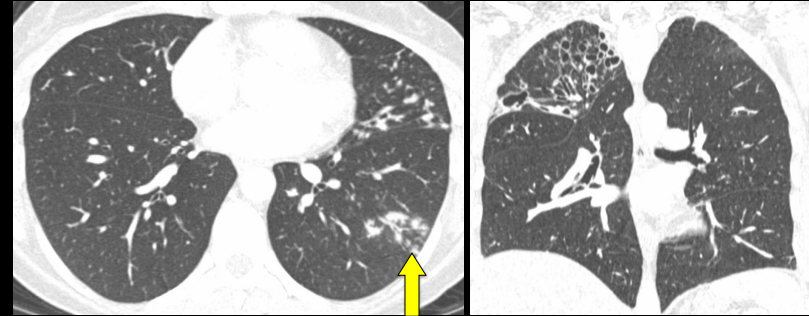
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Nodular Bronchiectatic



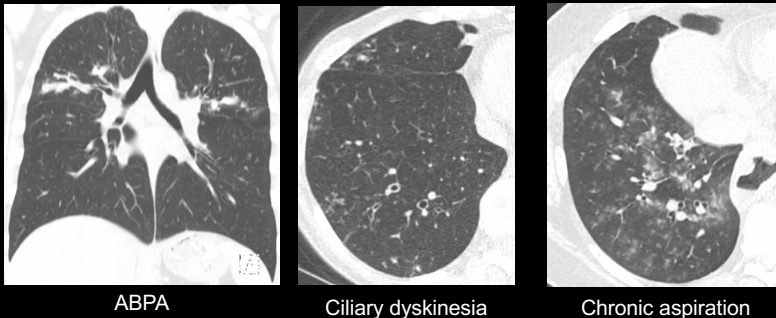
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Nodular Bronchiectatic



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Differential Diagnosis



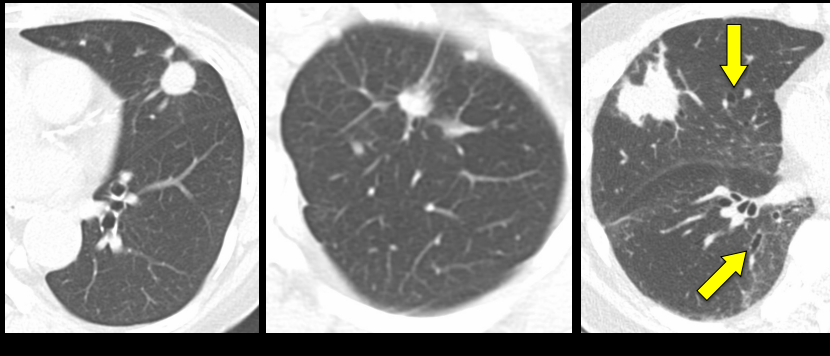
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Nodular

- NTM can occasionally present as solitary or few lung nodules
- Can mimic lung cancer
- Patients more likely to be asymptomatic
- Diagnosis usually requires biopsy

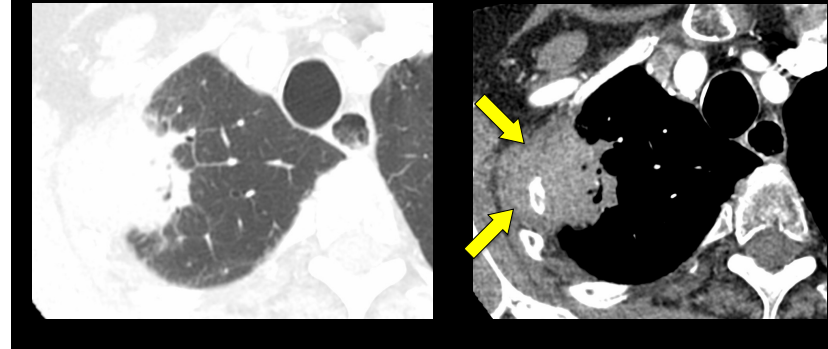
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Nodular



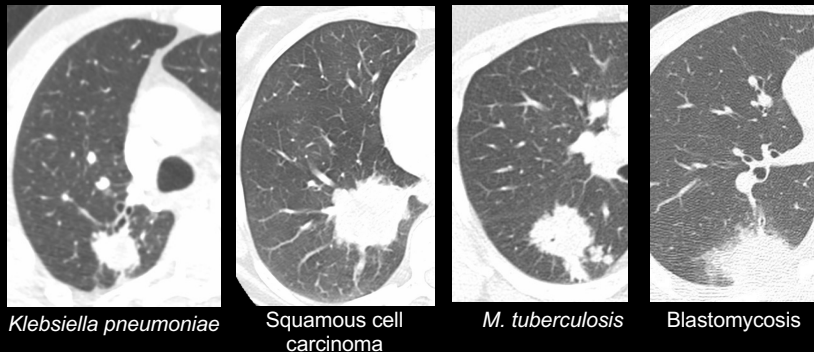
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Nodular



26

Differential Diagnosis



Klebsiella pneumoniae

Squamous cell carcinoma

M. tuberculosis

Blastomycosis

27

Hypersensitivity Pneumonitis

- Sometimes referred to as “hot tub lung”
- Aerosolized *M. avium* complex
- Results from hypersensitivity reaction
- Mimics HP from other causes, clinically and radiographically



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Hypersensitivity Pneumonitis

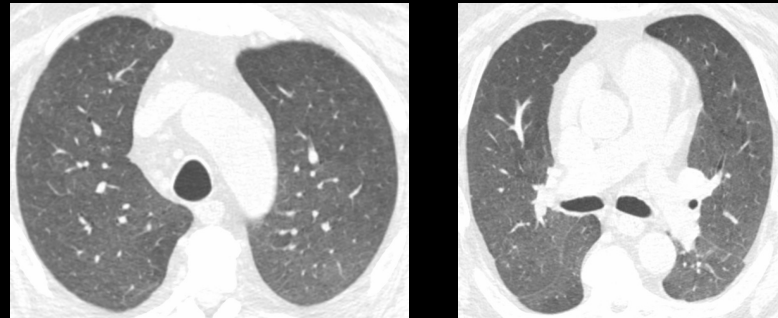
Infection or HP?

Histopathologic finding	HP	Hot Tub Lung
Granulomas	Poorly formed Interstitium	Well formed Interstitium and alveoli
Organizing pneumonia	Inconspicuous or absent	More pronounced
Chronic interstitial inflammation	Diffusely distributed	Associated more with granulomas

Agarwal R *Respir Med* 2006
 Hanak V et al. *Respir Med* 2006
 Franks TJ, Galvin JR. *Surg Pathol* 2010

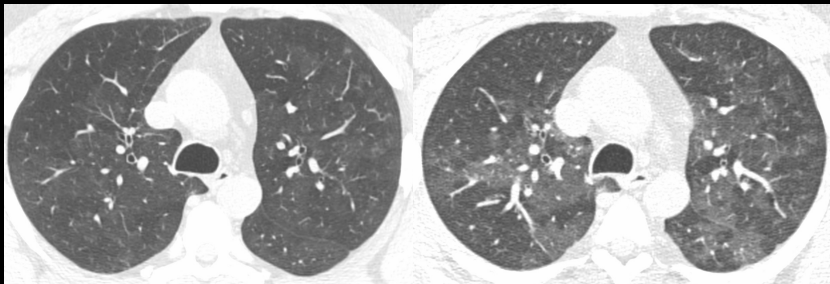
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Hypersensitivity Pneumonitis



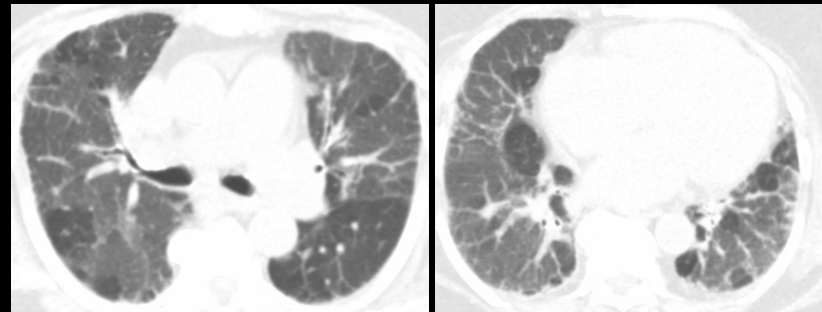
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Hypersensitivity Pneumonitis



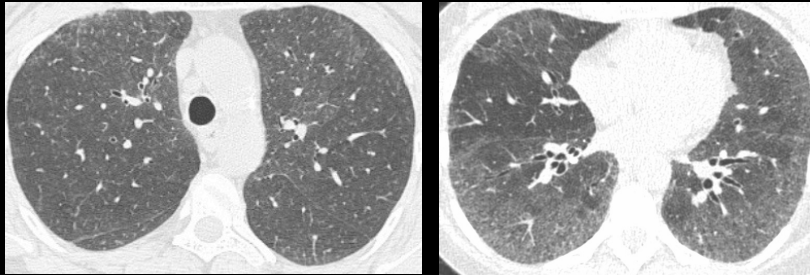
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Hypersensitivity Pneumonitis



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Differential Diagnosis



Respiratory bronchiolitis

NSIP

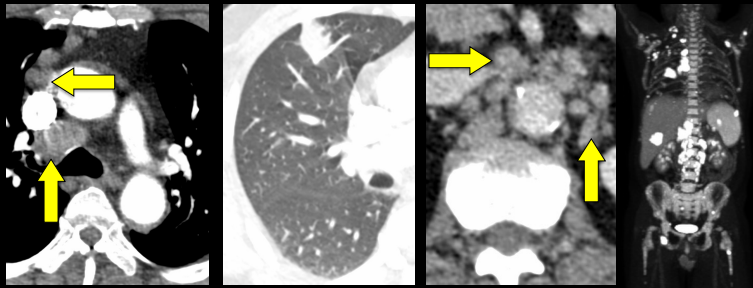
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Disseminated Disease

- Most commonly occurs with untreated HIV infection
 - CD4 count less than 100 cells/mm³
 - Usually spread from GI tract infection
- Patients typically present with systemic symptoms
- Hepatosplenomegaly and lymphadenopathy commonly found on physical examination
- Blood culture or lymph node biopsy needed for diagnosis

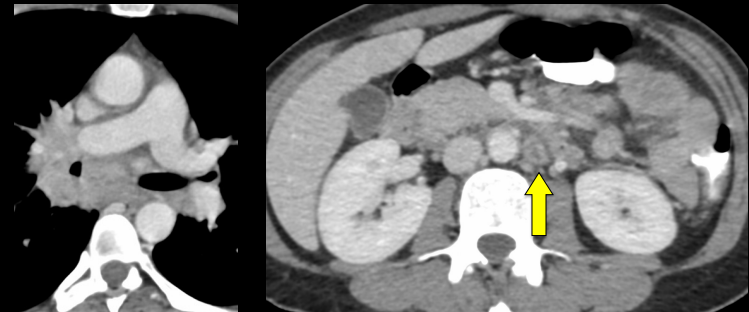
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Disseminated Disease



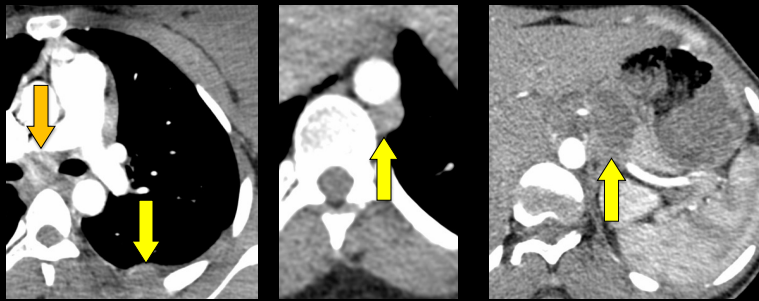
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Disseminated Disease



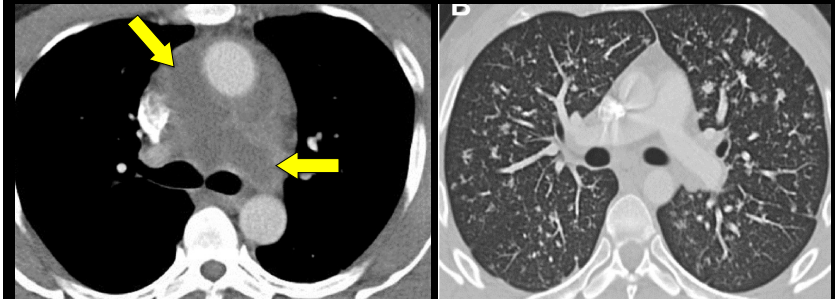
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Disseminated Disease



37

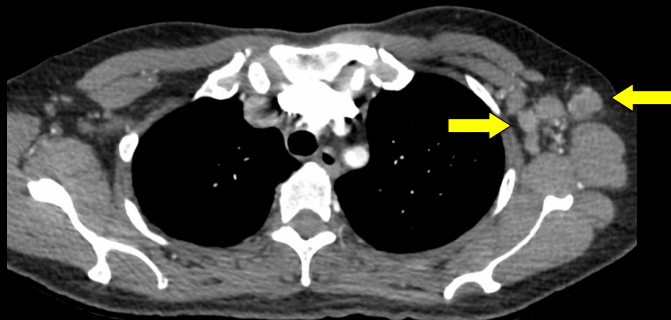
Disseminated Disease



Jamal F et al. *Radiol Clin North Am* 2022

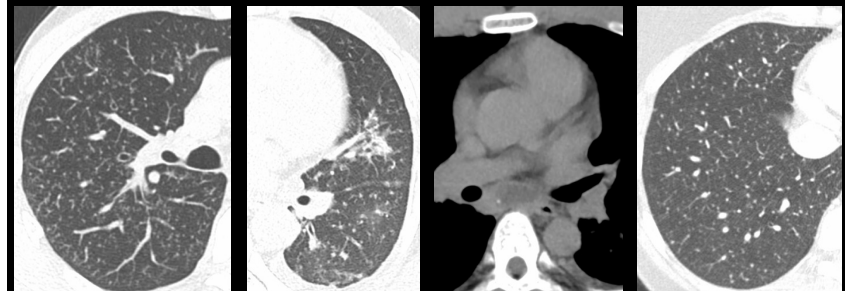
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Disseminated Disease



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Differential Diagnosis



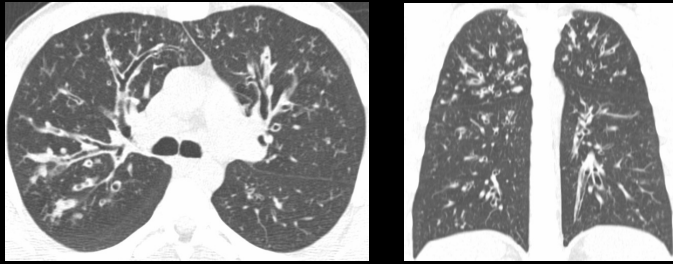
Sarcoidosis

Tuberculosis

Thyroid cancer

40

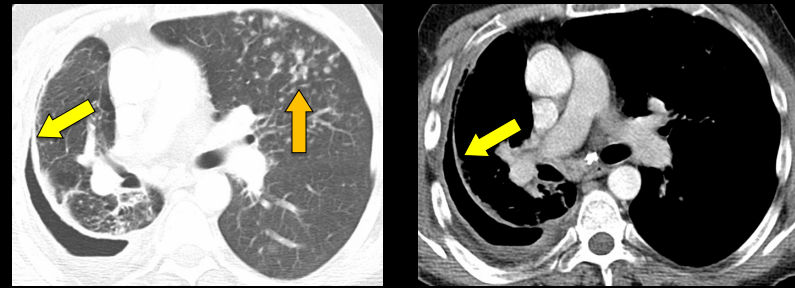
Special Cases



Cystic fibrosis – *M. abscessus*

41

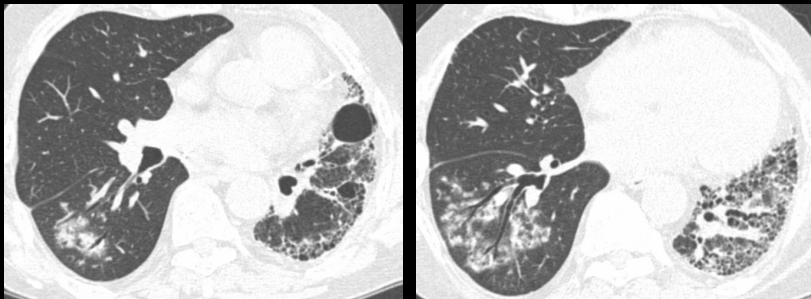
Special Cases



Empyema

42

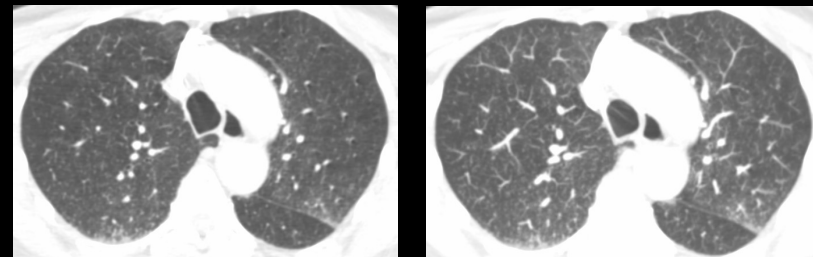
Special Cases



Lung transplant

43

Special Cases



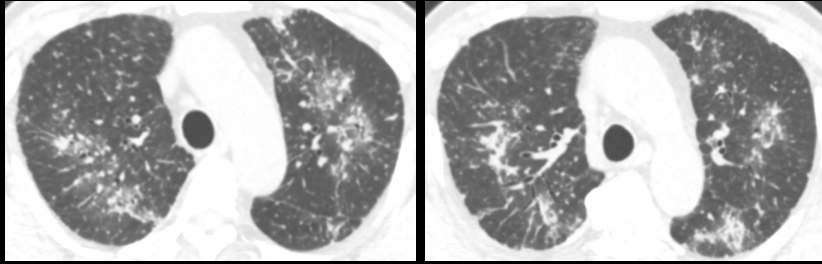
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MIP

M. bovis (BCG treatment for bladder cancer)

44

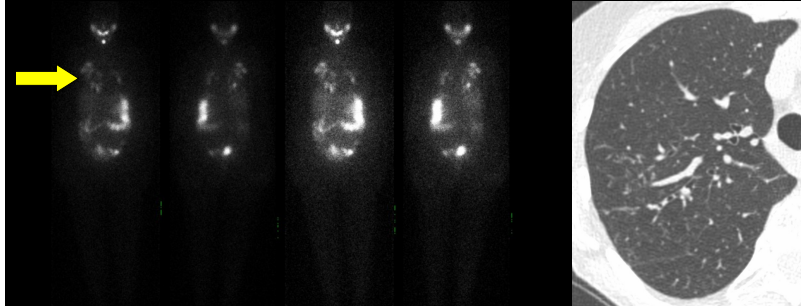
Special Cases



M. bovis (BCG and immunotherapy treatment for bladder cancer)

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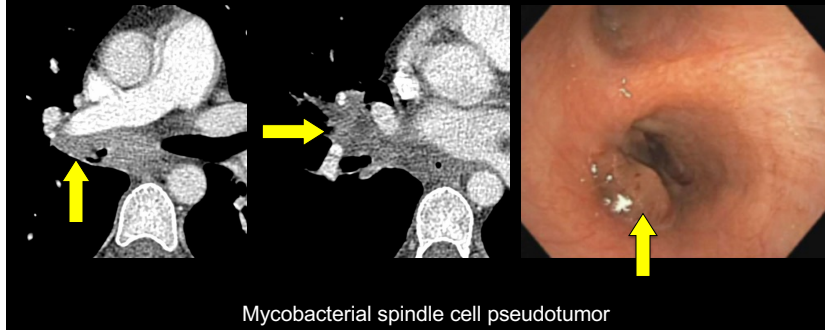
Special Cases



False positive uptake on I-121 scan for thyroid cancer – *M. avium* complex

46

Special Cases



Mycobacterial spindle cell pseudotumor

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Summary

- Nontuberculous mycobacterial infections are increasing globally
- More common than tuberculosis with low prevalence of the latter
- Imaging findings can be suggestive in the correct clinic settings

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