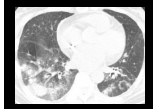
Febrile Neutropenia: Chest Imaging

Jeffrey P. Kanne, M.D., FACR, FCCP
Professor
Chief of Thoracic Imaging



DEPARTMENT OF RADIOLOGY
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

What is Febrile Neutropenia?

- Single oral temperature ≥ 38.3º C (101º F)

or

- Oral temperature ≥ 37º C (100.4º F)

and

- Absolute neutrophil count (ANC) < 1500 cells/μL

Punnapuzha S et al. *StatPearls* 2022

- Most common and most serious complication associated with hematologic malignancies and chemotherapy
- Affects ~1% of patients undergoing chemotherapy

Klastersky J et al. *Ann Oncol* 2016

2

Objectives

- Review the causes of febrile neutropenia (FN)
- Describe the role of thoracic imaging in evaluating FN
- Illustrate radiographic findings of infections commonly encountered in patients with FN

3

Causes

- Infections only documented in 30% of patients with FN
- Primary cause of morbidity and mortality in patients with FN and cancer
- Most infections are bacterial
  - –Gram positive bacteria now most common

Hakim H et al. *J Pediatr Hematol Oncol* 2009
Holland T et al. *Clin Infect Dis* 2014

4

Other Causes

- Medication associated lung injury
- Transfusion reaction
- Radiation associated lung injury
- Tumor related fever
- Leukemic infiltration of the lung
- Graft-versus-host disease

Heussel CP *Mycoses* 2011

5

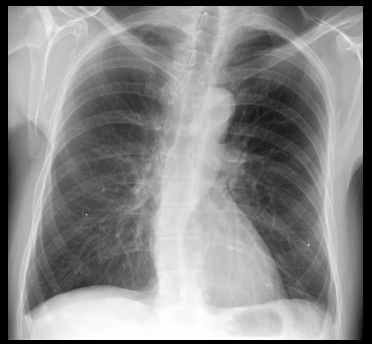
Evaluation

- History and physical exam
- Laboratory exam
  - CBC
  - Cultures
- Imaging

6

Radiography

- Radiography
  - Recommended only if pneumonia suspected
  - In practice, usually all patients with FN
  - Often initial exam
  - Low sensitivity especially with supine portable radiographs (<50%)



7

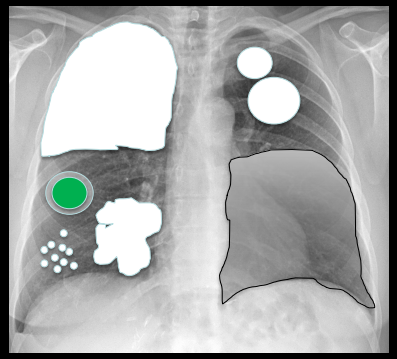
CT

- Prospective study of HRCT vs. radiography
  - 188 febrile neutropenic patients with normal radiograph
  - 60% had abnormalities on same-day HRCT
  - Of these, 50% had pneumonia confirmed by microbiology or subsequent chest radiography
  - Only 10% of patients with normal initial HRCT developed pneumonia

Heussel CP et al. *J Clin Oncol* 1999

8

Imaging Findings



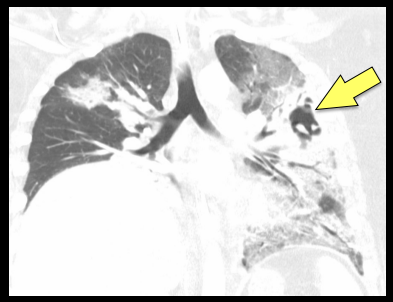
9

Imaging Findings

- Consolidation
  - –Bacteria
    - *Streptococcus*
    - *Staphylococcus*
    - Gram negatives
    - *Nocardia*

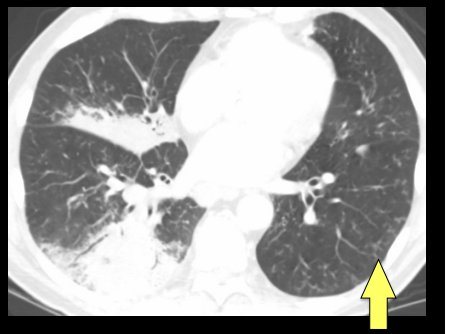
10

Staphylococcus aureus (MRSA)



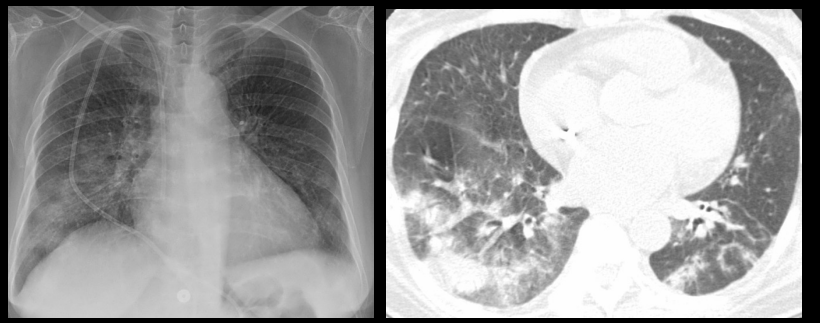
11

Nocardia cyriacigeorgica



12

Actinomyces israelii



Mucositis → Aspiration

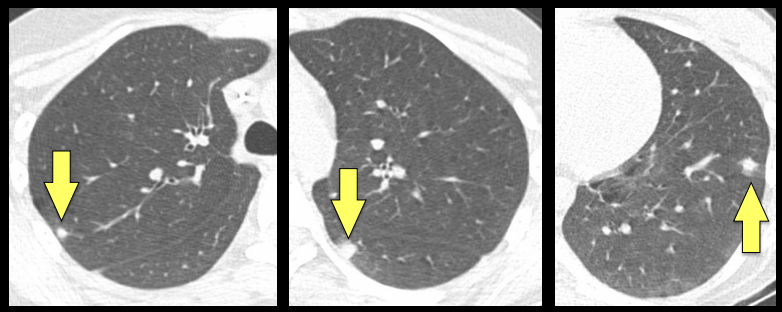
13

Imaging Findings

- Small nodules
  - –Fungi
  - –Cytomegalovirus
  - –Respiratory syncytial virus
  - –Other viruses

14

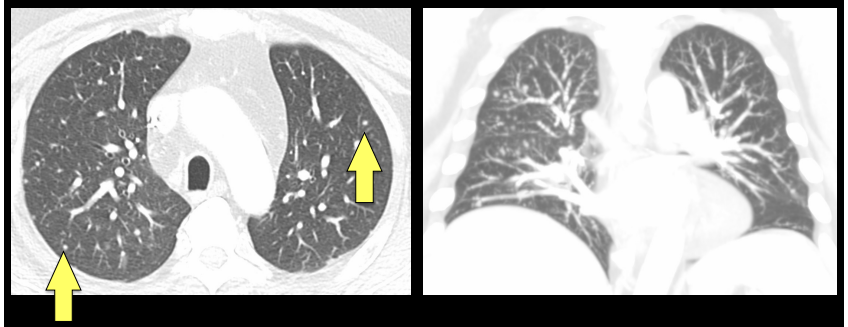
Candida albicans



🔑 Randomly distributed nodules > centrilobular nodules

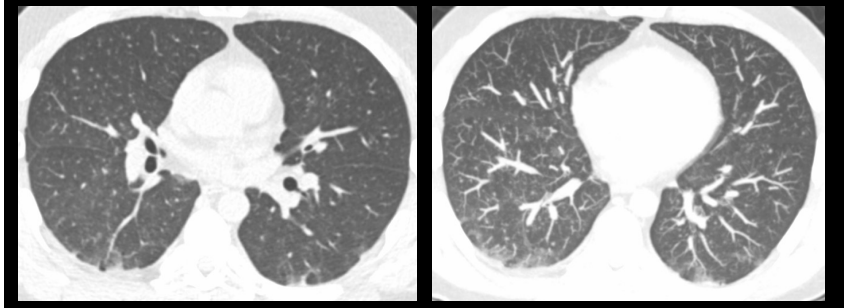
15

Candida tropicalis



16

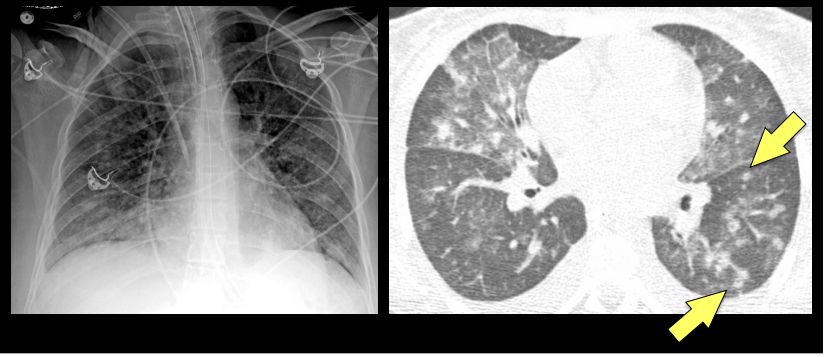
Cytomegalovirus



🔑 CMV viremia or antigenemia highly suggestive of active infection

17

Cytomegalovirus



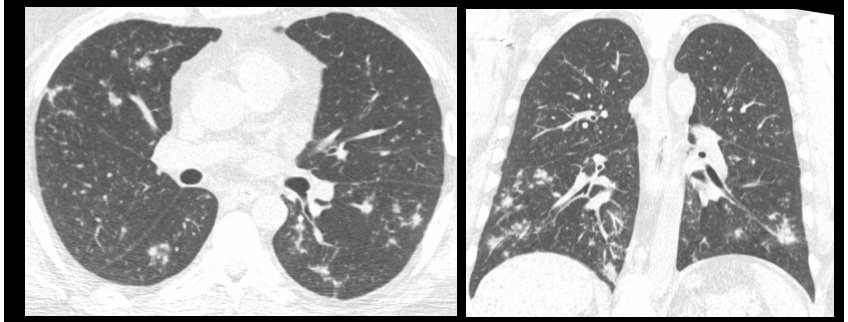
18

RSV

🔑 Centrilobular nodules often present

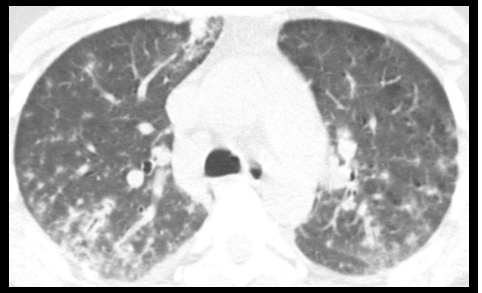
19

RSV



20

Measles Virus



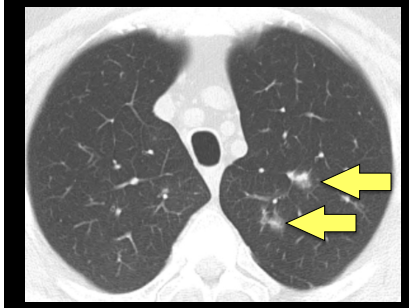
21

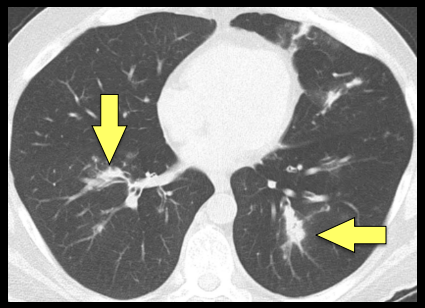
Imaging Findings

- Large nodules
  - –*Nocardia*
  - –*Aspergillus*

22

Nocardia nova

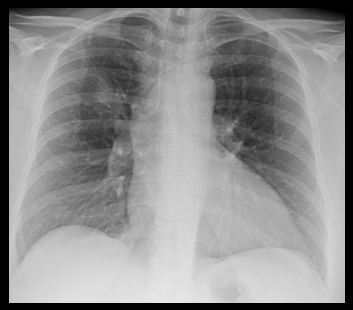


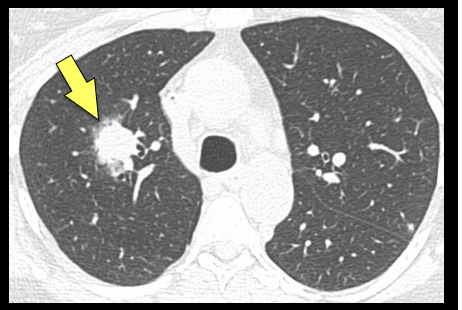


🔑 *Nocardia* often looks like fungus

23

Aspergillus fumigatus

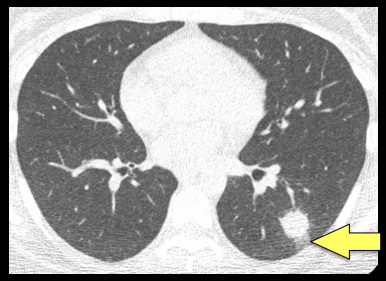




🔑 CT halo sign *suggestive* of angioinvasion

24

Aspergillus fumigatus

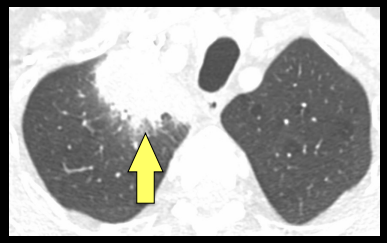


20 days layer

25

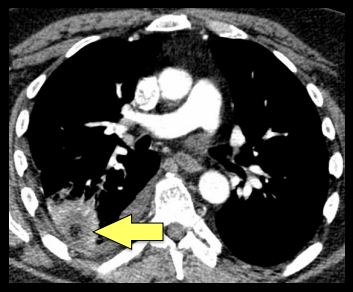
Imaging Findings

- Masses
  - –*Mucor*
  - –*Legionella*
  - –*Nocardia*
  - –Others



26

Mucor



🔑 Necrosis or infarcts are common

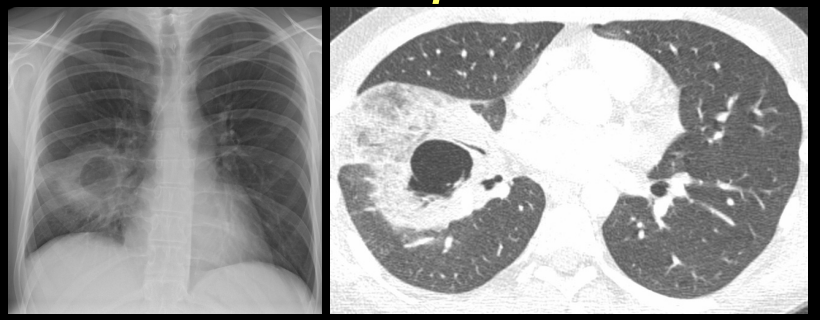
27

Mucor

🔑 Bird's nest sign highly suggestive

28

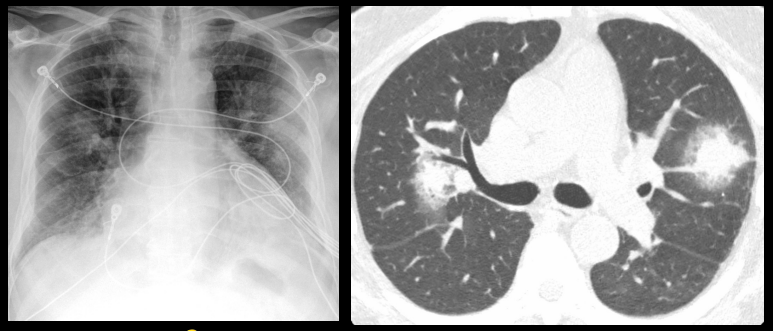
Rhizopus



🔑 Cavitation usually results from infarction and necrosis

29

Legionella pneumophila



🔑 Rapid radiographic progression

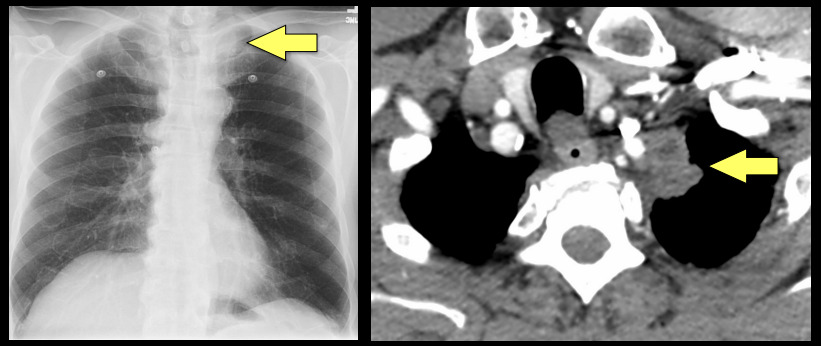
30

Legionella micdadei

🔑 Can mimic *Mucor* or *Aspergillus*

31

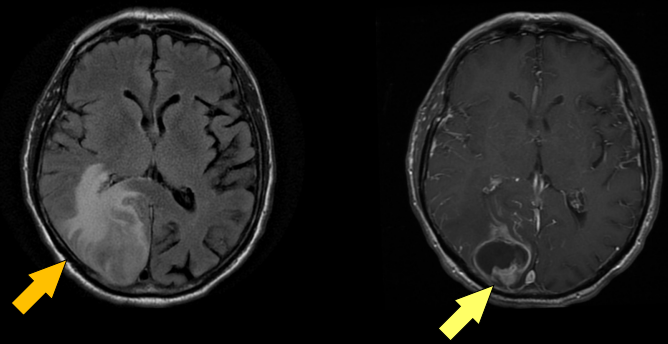
Nocardia nova



🔑 Mimics fungus, dissemination to CNS

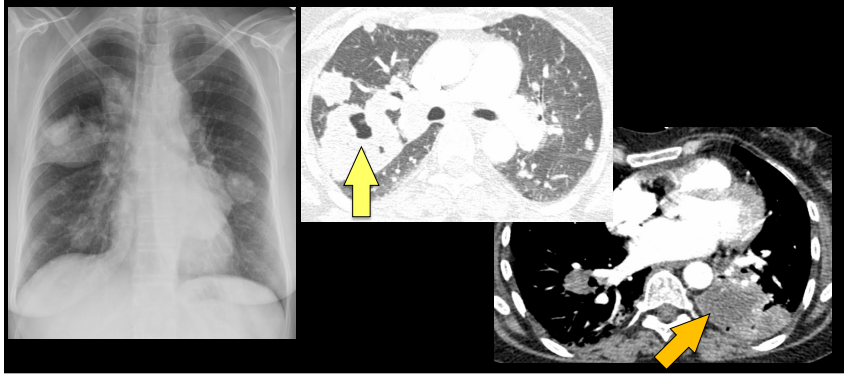
32

Nocardia nova



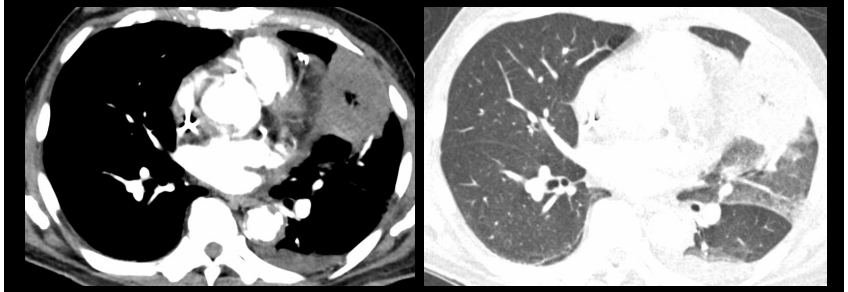
33

Nocardia cyriacigeorgica



34

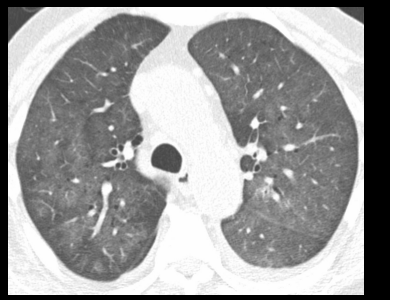
Naganishia albida



35

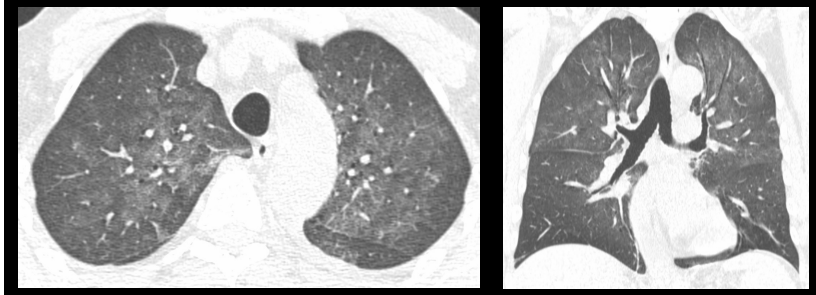
Imaging Findings

- Ground-glass opacity
  - –*Pneumocystis*
  - –Some viruses



36

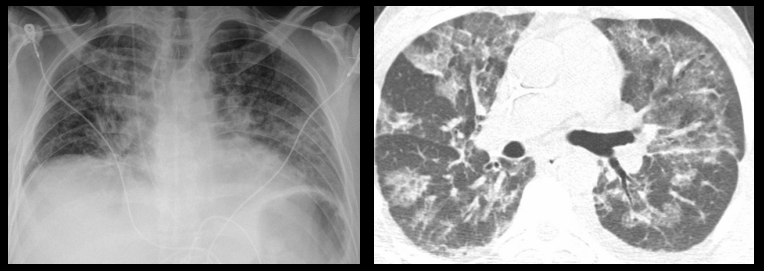
Pneumocystis jirovecii



🔑 Usually in patients on alternative (non-TMP-SMX) prophylaxis

37

Human Metapneumovirus



38

Imaging Findings

Predominant CT finding	Primary considerations
Consolidation	Bacteria
Small nodules	Fungus Virus – CMV, RSV
Large nodules	*Nocardia* *Aspergillus*
Masses	*Mucor* *Legionella*
Ground-glass opacity	*Pneumocystis* Virus
Bird's nest	*Mucor*
CT halo	*Aspergillus* *Mucor* *Nocardia*

39

Not Always Infection

40

PJP, Virus?

41

TRALI

42

Summary

- FN is a common and serious complication of chemotherapy and hematologic malignancies.
- Imaging, particularly CT, is useful for identifying lung infection as a cause of FN.
- Findings on chest CT *might* limit the differential diagnosis of cause of infection.

43

44