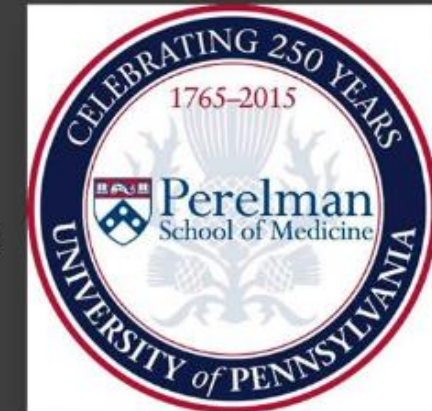




# Confidence Levels in Reporting COVID-19 on C T Imaging

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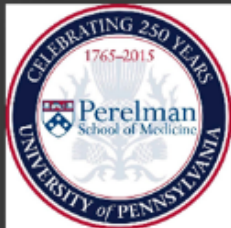
# Goals

- To improve reader identification of high, intermediate and low confidence features of COVID-19 on CT imaging
- To reduce reader variability in the reporting of the likelihood of COVID-19 on CT imaging
- Standardize reporting language to reduce variability in the interpretation of CT reports by clinicians



# Imaging features of COVID-19

- Bernheim et al assessed the CT's of 121 symptomatic patients over the course of 12 days who tested positive for COVID-19.
- Common features include:
  - Peripheral ground glass opacities, rounded morphologies, which were bilateral and multilobar
- Notable absent features were:
  - Central ground/perihilar ground glass opacities
  - Discrete solid nodules
  - Cavitation
  - Pleural effusions
  - Lymphadenopathy



# Reporting of COVID-19

- Assigning confidence levels to CT findings in clinically suspected COVID-19 cases is a means to:
  - Reduce reporting variability
  - Improve clinician interpretation of radiological reports
- A macro was created, “Macro Coronavirus” which is to be placed in the impression of the report
- This is **ONLY** to be used in:
  - Cases of clinically suspected COVID-19 (listed as an indication)
  - When the interpreting radiologist wants to invoke COVID-19 as a potential diagnosis – should be accompanied by direct communication with provider





# Macro Coronavirus

- When “Macro coronavirus” is entered into a report a picklist will be generated
- There will be four degrees of confidence to be assigned:
  - High confidence
  - Intermediate confidence
  - Low confidence
  - Alternative diagnosis
- The interpreting radiologist will choose a degree of confidence based on observed CT imaging findings
- This is to be placed in the impression

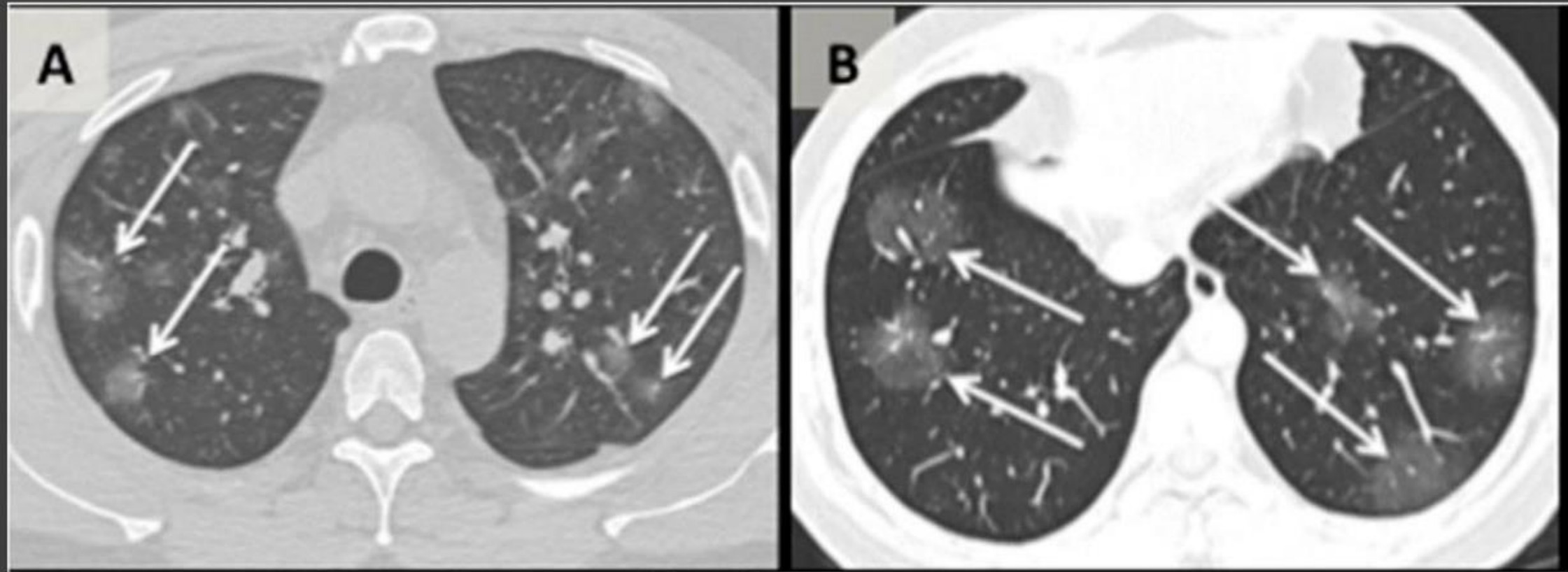


# High Confidence Features

- **“High confidence features for COVID-19** (in the appropriate clinical setting) Although other processes can cause a similar pattern, consider viral testing for confirmation or exclusion of this possibility. [Co-Hi]”
- CT features:
  - Peripheral, bilateral (multilobar), ground glass opacities with or without consolidation or intermixed septal thickening
  - Multifocal ground glass opacities of rounded morphology with or without consolidation or intermixed septal thickening



# High Confidence Features



Rounded multifocal ground glass opacities bilaterally

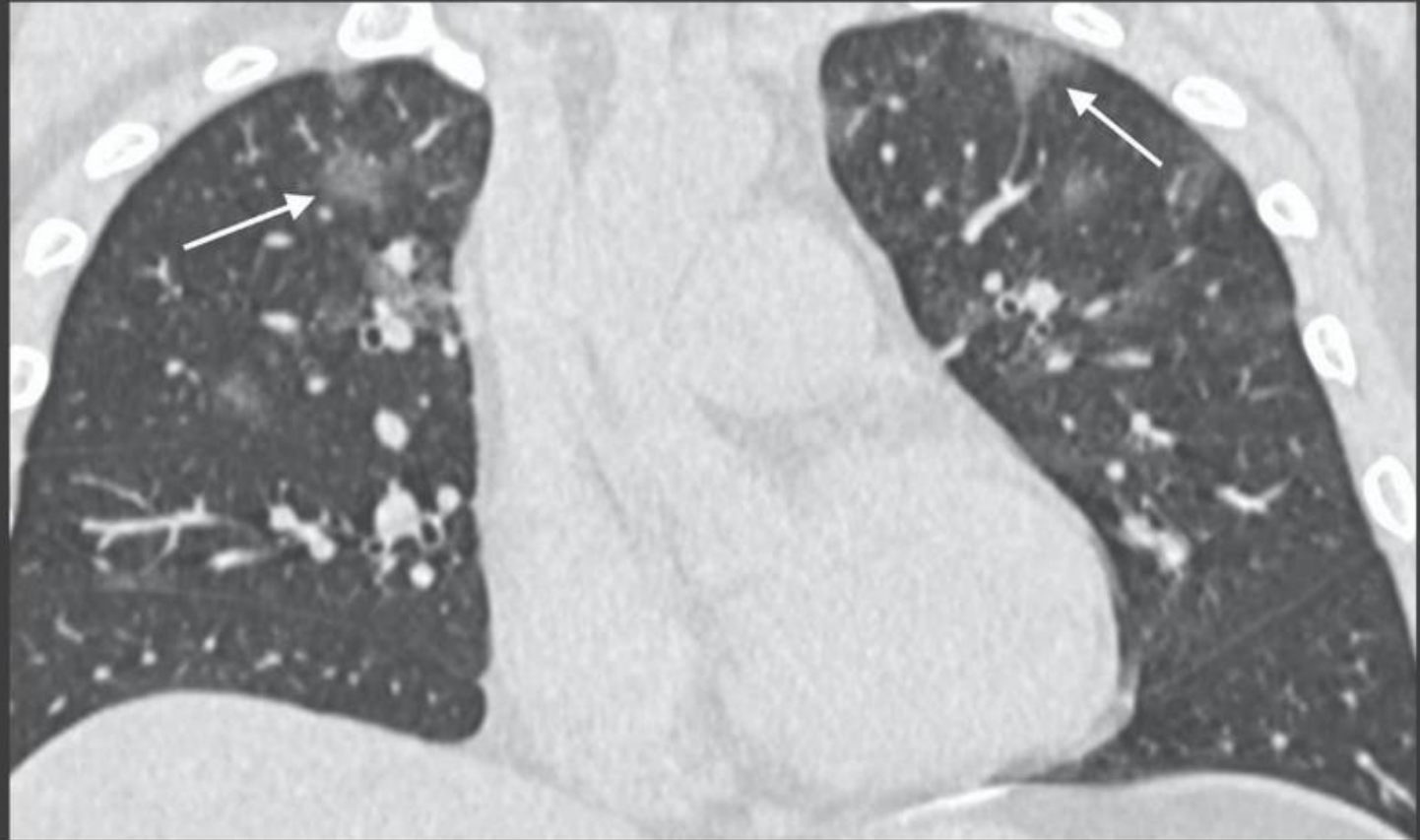


Bernheim Radiology 2020



# High Confidence Features

- Rounded multifocal bilateral ground glass opacities

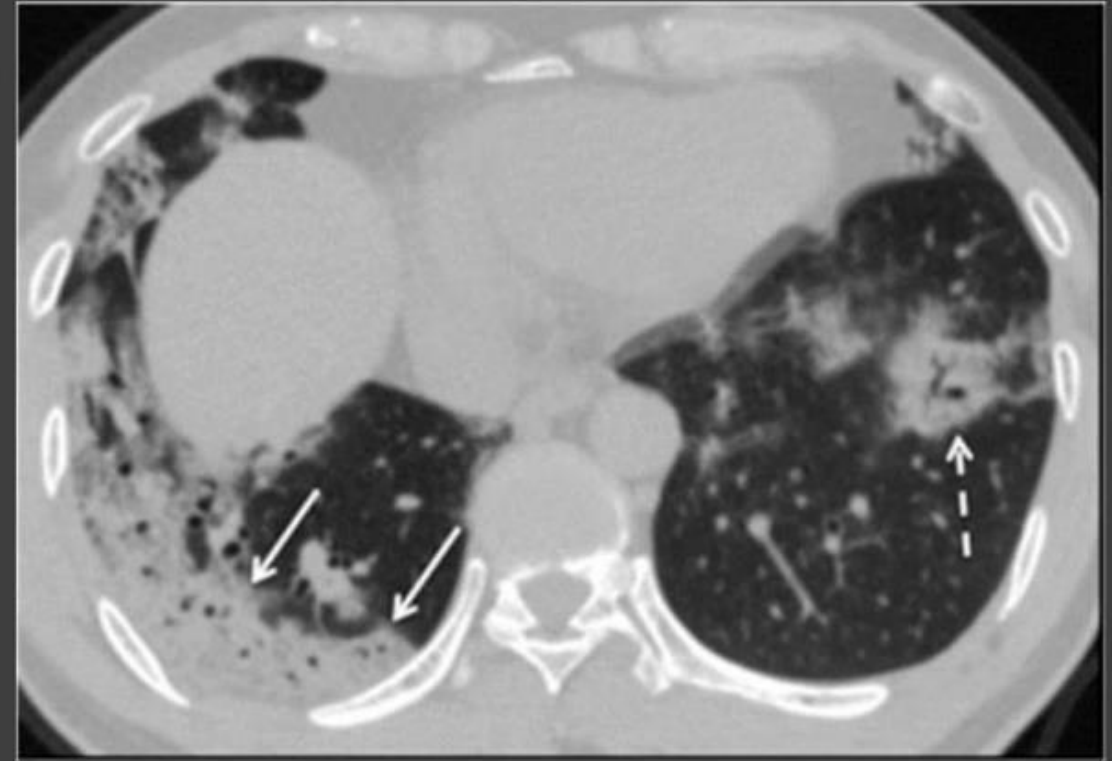


Chung Radiology 2020





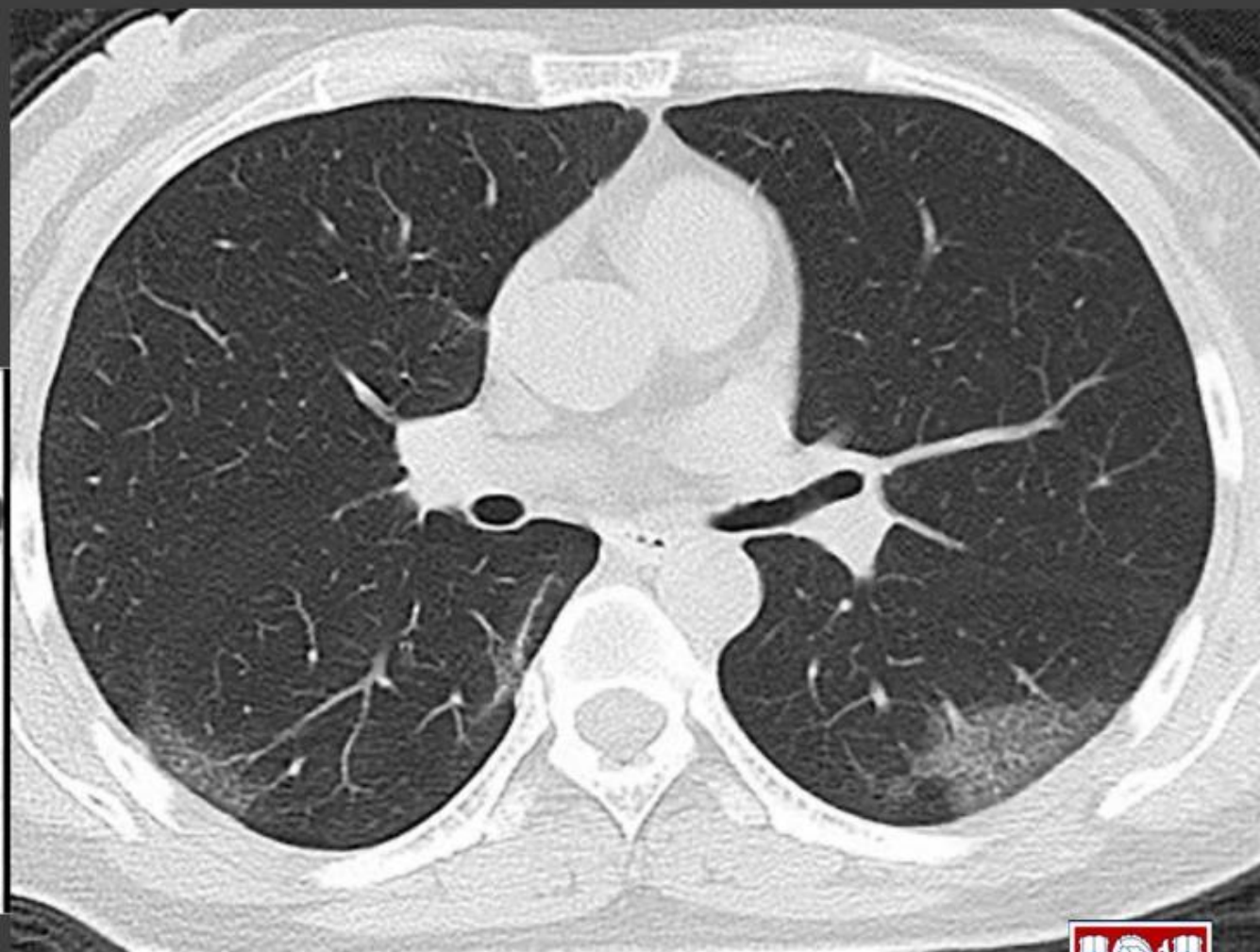
# High Confidence Features



Peripheral bilateral ground glass opacities (left) with consolidation (right).  
Note rounded morphology of consolidation with airbronchogram (dashed arrow)

# High Confidence Features

- Bilateral peripheral ground glass opacities with intermixed septal thickening, crazy paving.

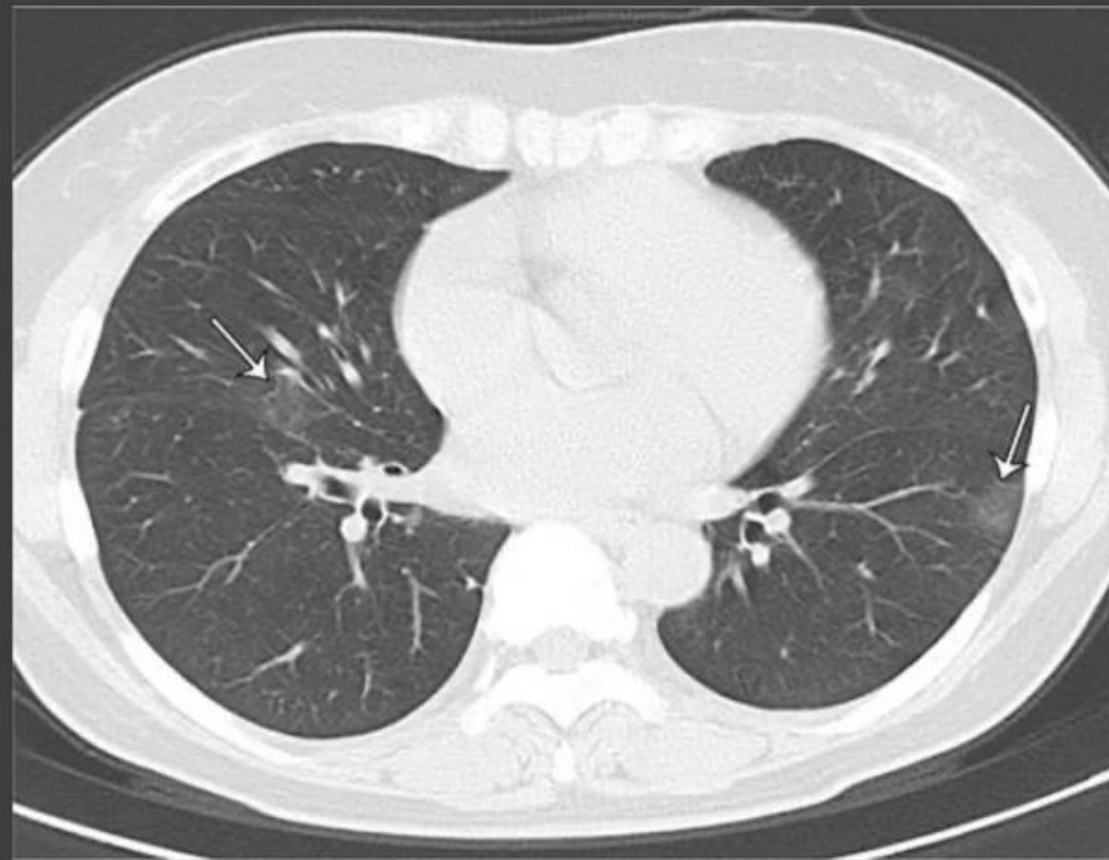
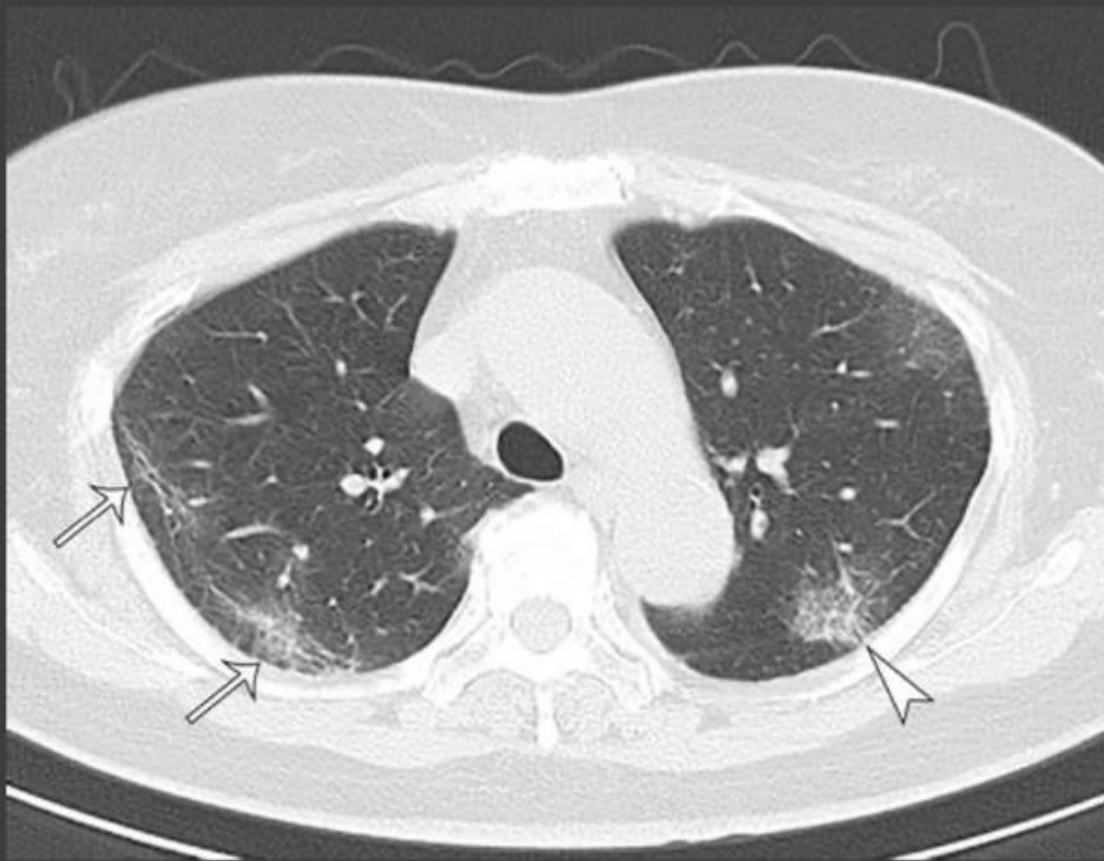


Duan Radiology 2020





# High Confidence Features



Rounded and peripheral ground glass opacities in COVID-19

Inui Radiology 2020



# Intermediate Confidence Features

- **“Intermediate confidence features for COVID-19** in the appropriate clinical setting. However, the findings are nonspecific, and other infectious or non-infectious processes can cause the same pattern. [Co-In]”
- **CT Features:**
  - Multifocal ground glass opacities with or without consolidation that are without a clear distribution and nonrounded.
  - Unilateral ground glass opacity with or without consolidation





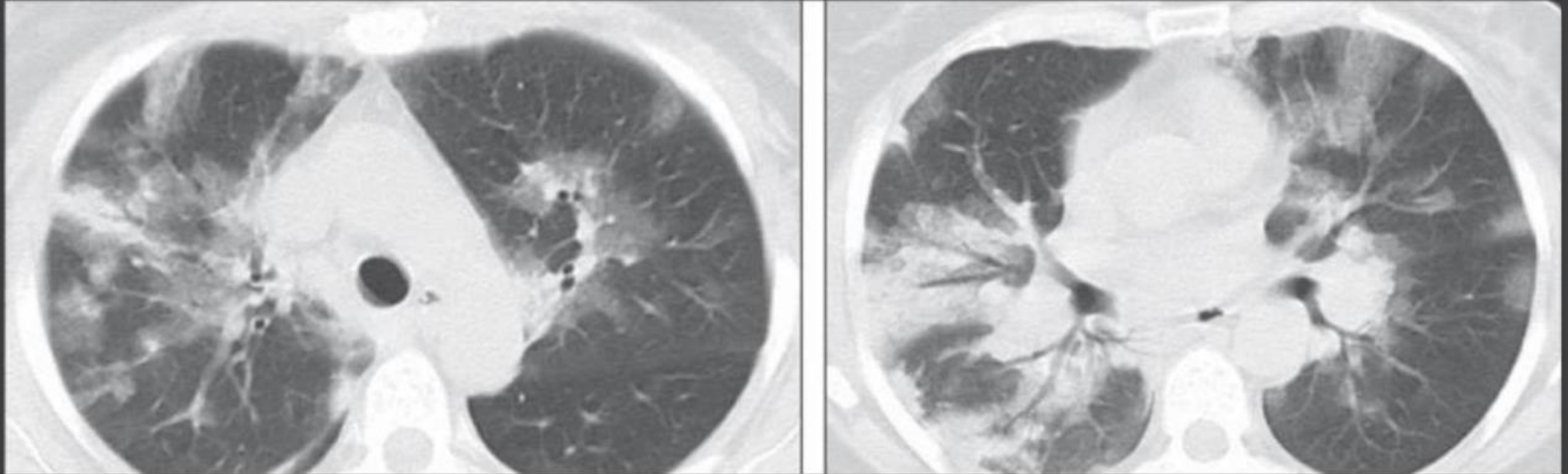
# Intermediate Confidence Features



Bilateral ground glass opacities and consolidation in COVID-19  
Bai Radiology 2020



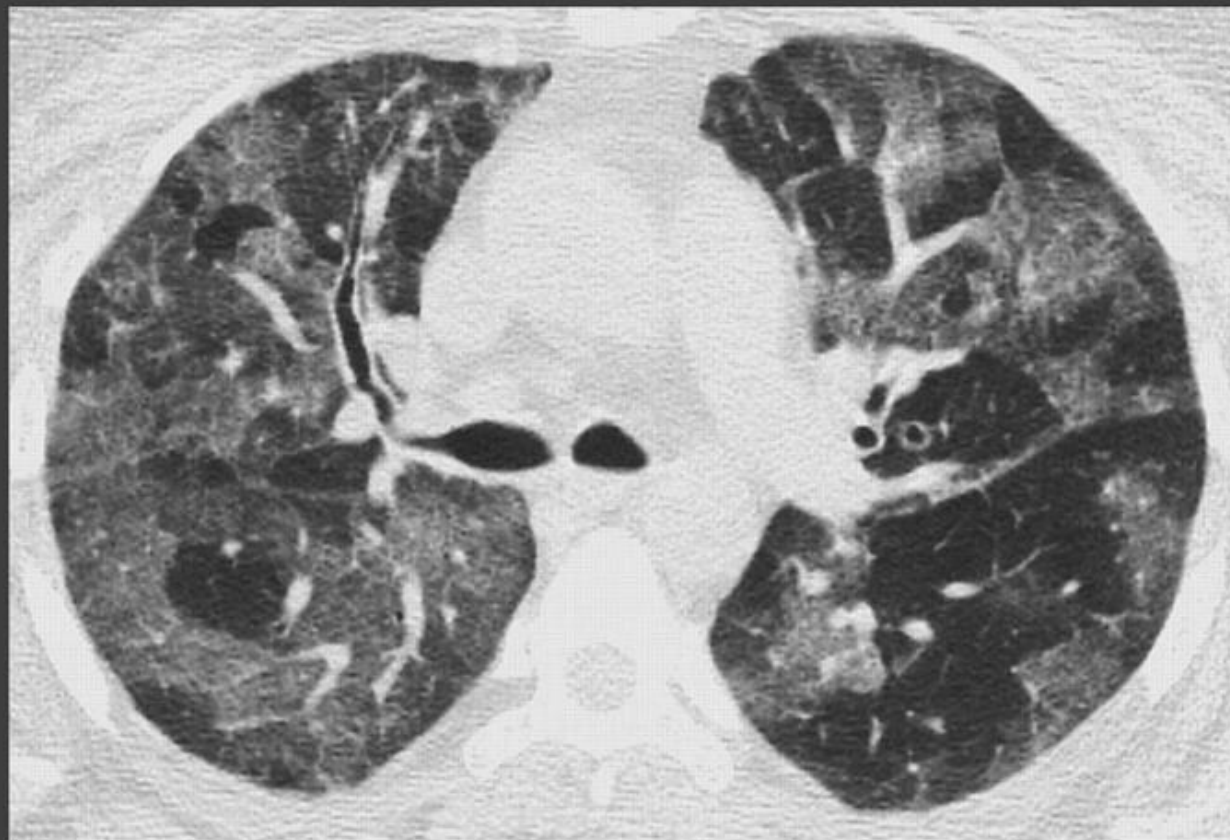
# Intermediate Confidence Features



Multifocal nonrounded nonperipheral bilateral ground glass opacities  
H1N1 Flu pneumonia



# Intermediate Confidence Features



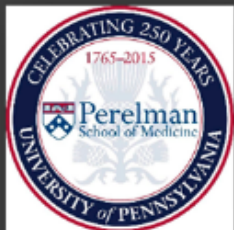
Diffuse bilateral ground glass opacities without clear distribution,  
unknown cause





# Low Confidence Features

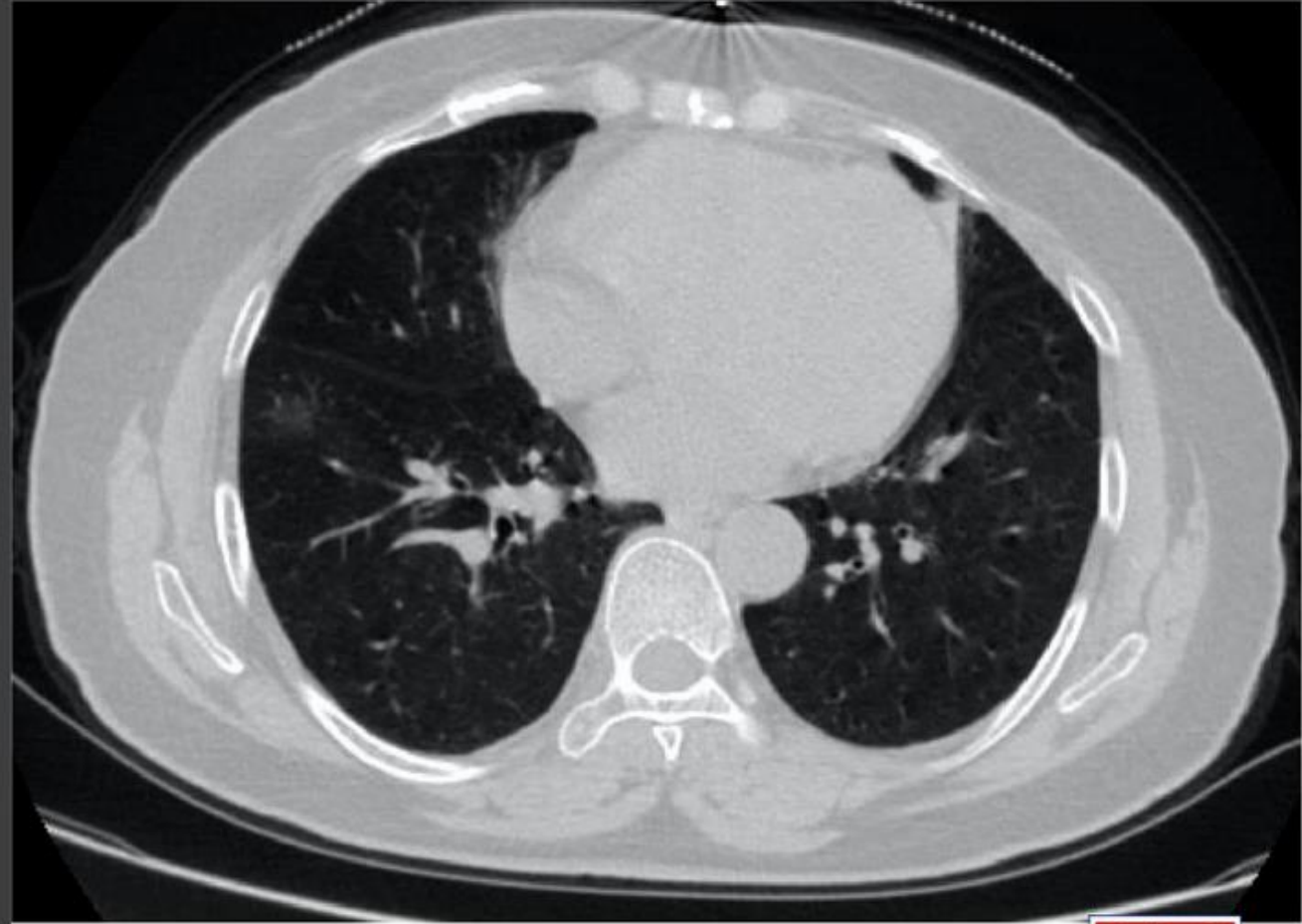
- **“Low confidence features for COVID-19 associated pneumonia. In the absence of specific clinical context, the findings are less likely to be secondary to COVID-19 pneumonia. [Co-Lo]”**
- CT features:
  - Lobar pattern of consolidation
  - Consolidation *without* ground glass opacity
  - Less than a few very small ground glass opacities with nonrounded and nonperipheral distribution





# Low Confidence Features

- Single very small site of ground glass opacity in early COVID-19

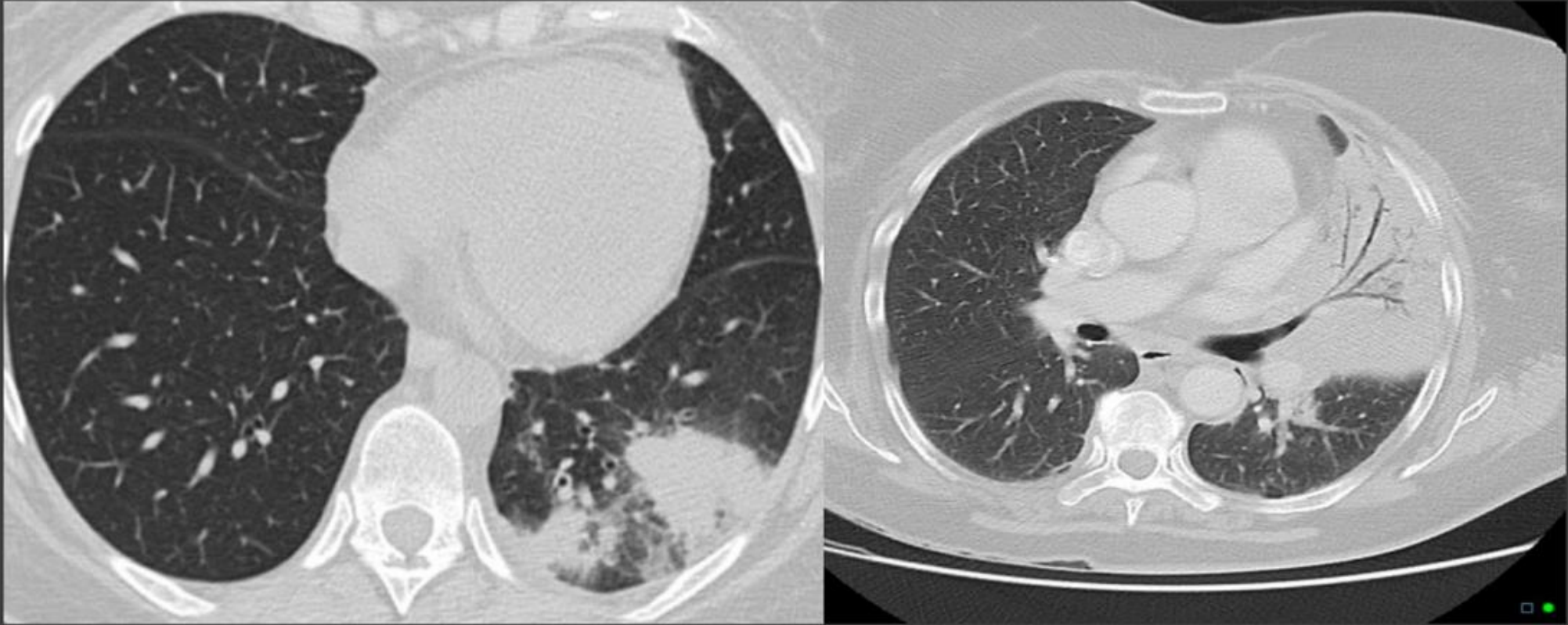


D.

Bai Radiology 2020



# Low Confidence Features



Lobar or segmental pattern of consolidation in bacterial pneumonia



# Alternative Diagnosis

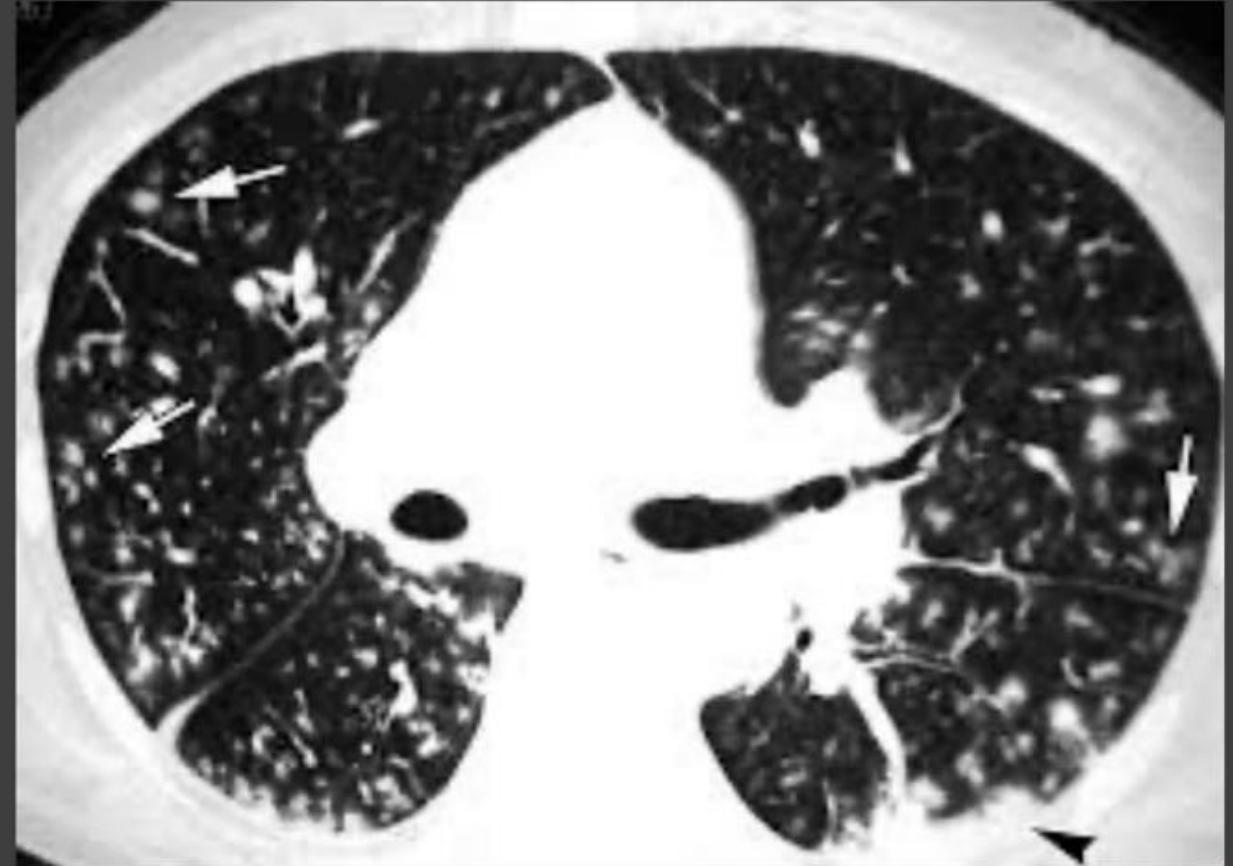
- “Findings unlikely to represent COVID-19 – alternative diagnosis favored. [Co-Ad]”
- CT features:
  - Discrete nodules (centrilobular, tree in bud, rounded small nodules)
  - Cavitation
  - Perihilar ground glass opacities
  - Smooth septal thickening with pleural effusions (pulmonary edema pattern)
  - Subpleural reticulation without groundglass opacities (fibrotic pattern)





# Alternative Diagnosis

- Multiple centrilobular nodules in the setting of Rhinovirus infection





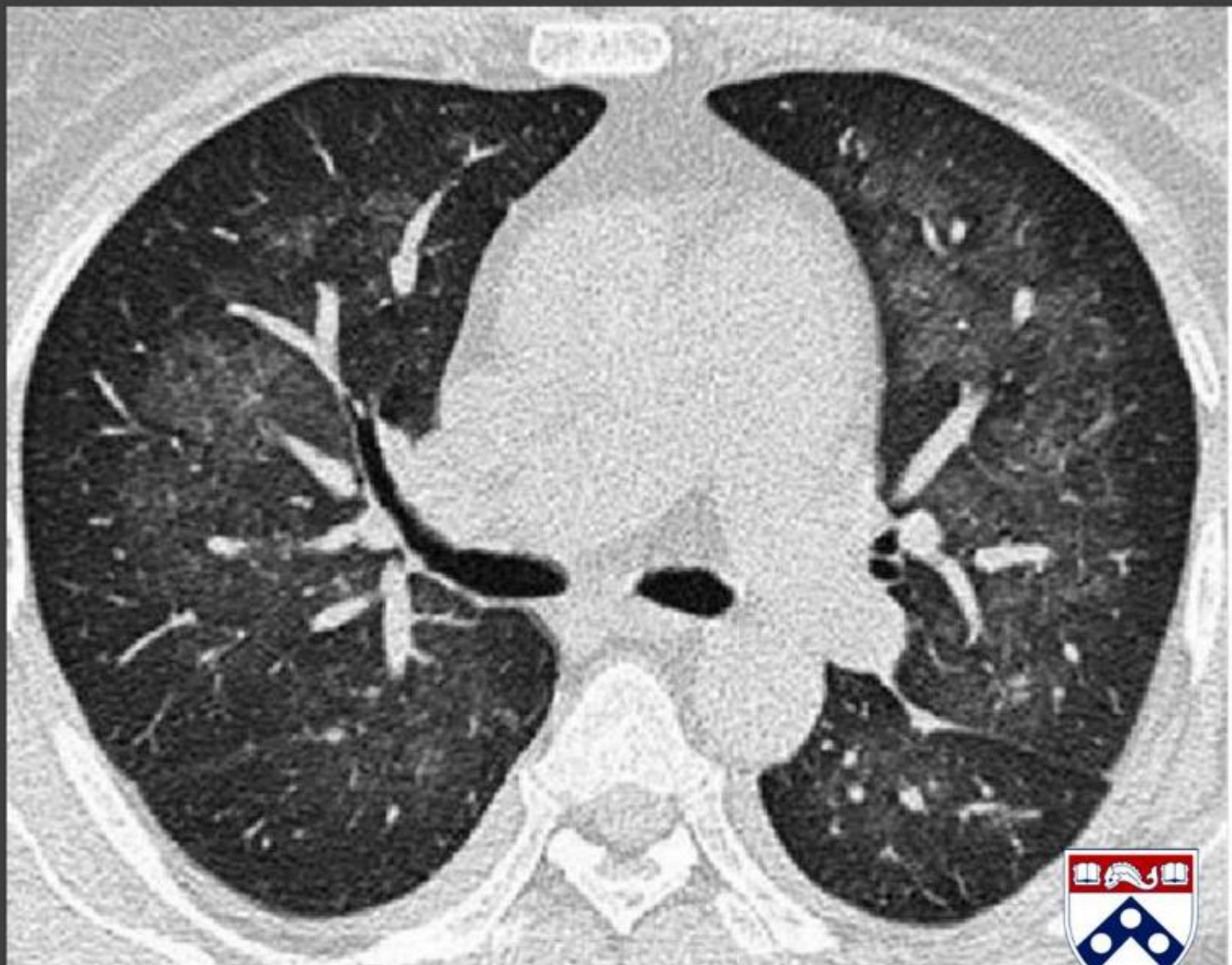
# Alternative Diagnosis

- Centrilobular nodules, consolidation and cavitation in the setting of mycobacterial infection



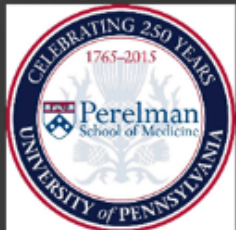
# Alternative Diagnosis

- Perihilar ground glass opacities in the setting of PCP pneumonia



# Summary features

- High confidence
  - Peripheral, bilateral (multilobar), ground glass opacities with or without consolidation or crazy paving
  - Multifocal ground glass opacities of rounded morphology with or without consolidation or crazy paving
- Intermediate confidence
  - Multifocal ground glass opacities with or without consolidation that are without a clear distribution and nonrounded
  - Unilateral ground glass opacity with or without consolidation





# Summary Features

- Low confidence
  - Lobar pattern of consolidation
  - Consolidation without ground glass opacity
  - Less than a few very small ground glass opacities (nonperipheral, nonrounded)
- Alternative diagnosis
  - Discrete nodules (centrilobular, tree in bud)
  - Cavitation
  - Perihilar ground glass opacities
  - Smooth septal thickening with pleural effusions (pulmonary edema pattern)
  - Subpleural reticulation



# Conclusions

- When there is a study specifically ordered for COVID-19 assessment **OR** the interpreting radiologist wants to invoke COVID-19 as potential diagnosis, we are mandating the use of “Macro Coronavirus”.
- Then chose a confidence level based on observed findings within the pick list.
- This is to be placed in the impression of the report.



# Thank you!

