SJIF Impact Factor: 5.464

WORLD JOURNAL OF ADVANCE HEALTHCARE RESEARCH

ISSN: 2457-0400
Volume: 4.
Issue: 3.
Page N. 210-214
Year: 2020

Review Article www.wjahr.com

NOVEL CORONAVIRUS (COVID-19) INFECTION AND ITS RADIOGRAPHIC APPEARANCE IN COMPUTED TOMOGRAPHY

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Received date: 28 March 2020 **Revised date:** 18 April 2020 **Accepted date:** 08 May 2020

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ABSTRACT

Medical Imaging plays a vital role in the diagnostic field. In recent time the corona virus COVID-19 became pandemic as announced by the World Health Organization (WHO). Screening Computed Tomography for the identification of Novel Coronavirus (COVID-19) pneumonia is currently not recommended by most countries. However, the number of Computed Tomography performed in persons under investigation for Novel Coronavirus (COVID-19) has increased. But it is necessary to have the knowledge about the Radiographic appearance of chest CT images. Radiologists recognize findings of Novel Coronavirus (COVID-19) pneumonia and aid their communication with other healthcare providers, assisting management of patients during this pandemic. Typical imaging findings may encourage repeat testing in the cases of initial RT-PCR tested negative patient.

KEYWORDS: Computed Tomography, Novel Coronavirus (COVID-19), Radiographic appearance.

INTRODUCTION

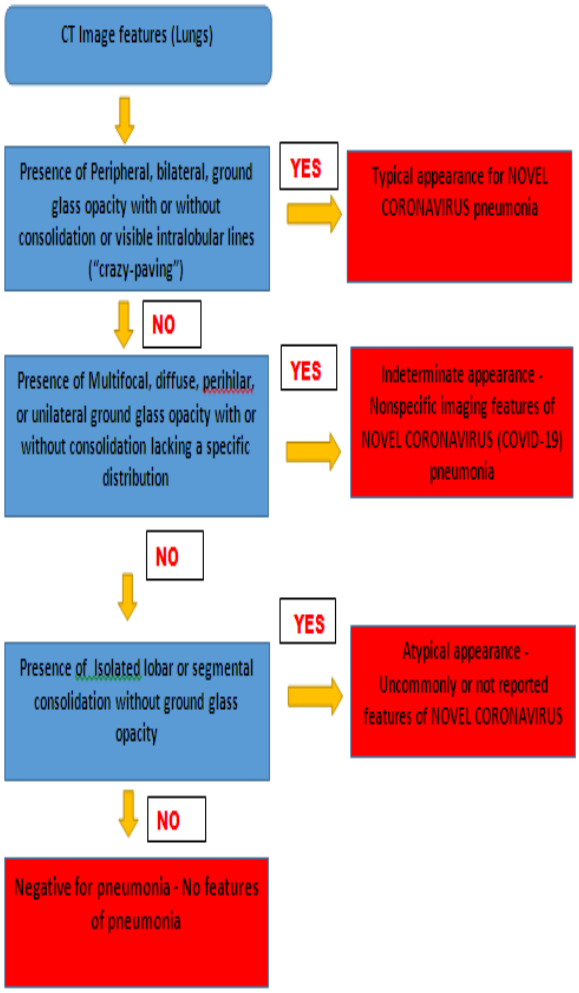
Coronavirus disease 2019 (Novel Coronavirus (COVID-19))[1] is caused by SARS-CoV-2[2] (Severe Acute Respiratory Syndrome coronavirus 2). It has become increasingly prevalent worldwide, reaching a pandemic stage in March 2020.[3] Many radiology professional organizations have recommended against performing screening computed tomography (C T) for the identification of Novel Coronavirus (COVID-19)[4,5] But the number of Computed Tomography performed in persons under investigation for Novel Coronavirus (COVID-19) may increase. The physician anticipate that patients will have incidental lung findings on Computed Tomography obtained for unrelated reasons that could be attributable to Novel Coronavirus (COVID-19).

The recent articles have described the evolution of the image features over time, and the performance of radiologists in distinguishing Novel Coronavirus (COVID-19) from other viral infections.[6-10] These studies shown that Novel Coronavirus (COVID-19) often produces an image pattern resembling organizing pneumonia, notably peripheral ground-glass opacities (GGO) and nodular or mass-like GGO that are often bilateral and multilobar.[11] But, additional imaging findings have also been reported including linear, curvilinear or perilobular opacities, consolidation, and diffuse Ground glass opacity, which can resemble several disease processes including other infections and drug toxicities.[12-15] This article aims to provide guidance to radiologists reporting Computed Tomography findings potentially attributable to Novel Coronavirus (COVID-19) pneumonia when discovered incidentally. The image features gives the knowledge to differentiate other findings from the Novel Coronavirus (COVID-19) pneumonia.

Chest Computed Tomography in Novel Coronavirus (COVID-19) Infection

Several publications have found that Novel Coronavirus (COVID-19) typically presents with Ground glass opacity with or without consolidation in a peripheral, posterior, and diffuse or lower lung zone distribution.[6-11] Moreover, a significant portion of cases have opacities without a clear/ specific distribution.[8] Mucoid impaction, bronchial wall thickening, and nodules seen commonly in infections, are not have been typically observed.[8] Pleural effusion and lymphadenopathy are rarely reported.[6]

The image interpretation sequence is given in the following flow diagram.



Novel Coronavirus (COVID-19) pneumonia imaging classification

The Computed Tomography images of chest can be classified as the following with respect to Novel Coronavirus (COVID-19) pneumonia.

1. Typical appearance
2. Indeterminate appearance
3. Atypical appearance
4. Negative for pneumonia

1. Typical appearance

It is defined as the commonly reported imaging features which has greater specificity for Novel Coronavirus (COVID-19) pneumonia. There are of the following types.

a) Peripheral, bilateral, ground glass opacity with or without consolidation or visible intralobular lines ("crazy-paving").

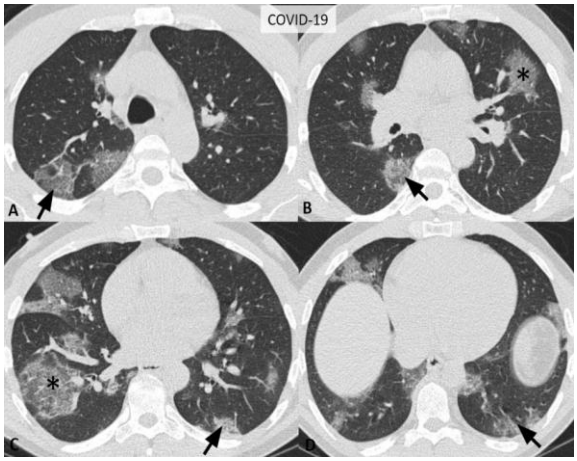


Figure 1(A-D): Thin-Section Axial Images Of The Lungs In A 52-Year-Old Man With A Positive RT-PCR.

This unenhanced image show bilateral, multifocal rounded (asterisks) and peripheral ground glass opacity (GGO) (arrows) with superimposed interlobular septal thickening and visible intralobular lines ("crazy-paving").

This reveals typical Computed Tomography imaging features for Novel Coronavirus (COVID-19).

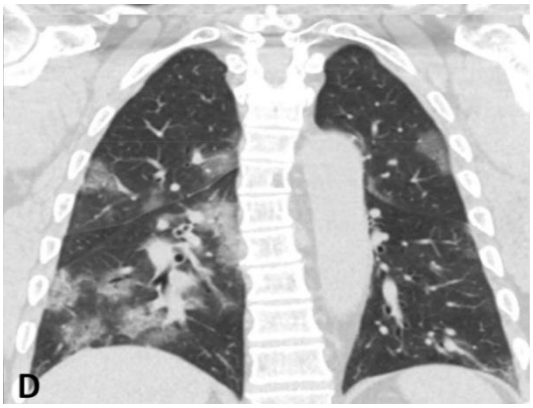


Figure 2: Multi planar reconstructed (coronal) (MPR) images (D) of the lungs in a 77-year-old man with a positive RT-PCR show bilateral, multifocal rounded and peripheral Ground Glass Opacity.

b) Multifocal ground glass opacity of rounded morphology with or without consolidation or visible intralobular lines ("crazy-paving")

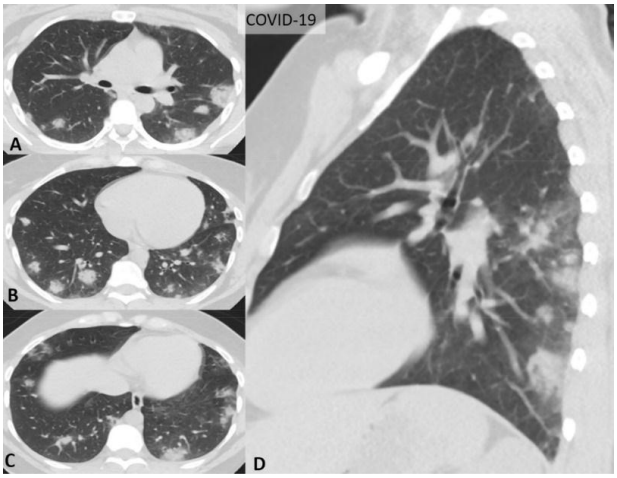


Figure 3: Shows unenhanced axial (A-C) and sagittal Multi Planar Reconstruction (D) images of the lungs in a 29-year-old man with a positive RT-PCR.

This image shows multiple bilateral, rounded consolidations with surrounding Ground Glass Opacity. This is one of the typical Computed Tomography imaging features for Novel Coronavirus (COVID-19).
c) Reverse halo sign or other findings of organizing pneumonia (seen later in the disease)

2. Indeterminate appearance
It is defined as the nonspecific imaging features of Novel Coronavirus (COVID-19) pneumonia.
Absence of typical features AND Presence of:
a) Multifocal, diffuse, perihilar, or unilateral ground glass opacity with or without consolidation lacking a specific distribution and are non-rounded or non-peripheral.

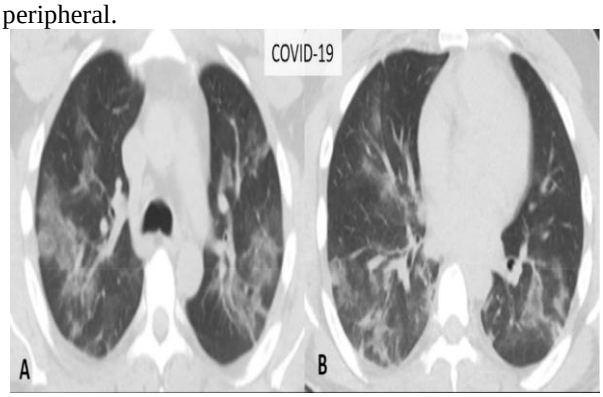


Figure 4: Unenhanced Axial Images In Patient Showing Patchy GGO With Nonrounded Morphology And No Specific Distribution, In A Case Of NOVEL CORONAVIRUS (COVID-19) Pneumonia (A,B).

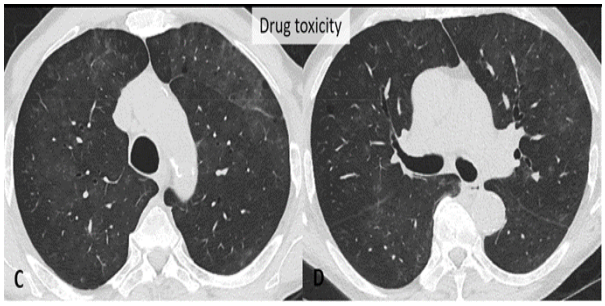


Figure 5: Unenhanced Axial Images Shows acute lung injury from presumed drug toxicity (C,D).

b) Few very small ground glass opacity with a non-rounded and non-peripheral distribution.

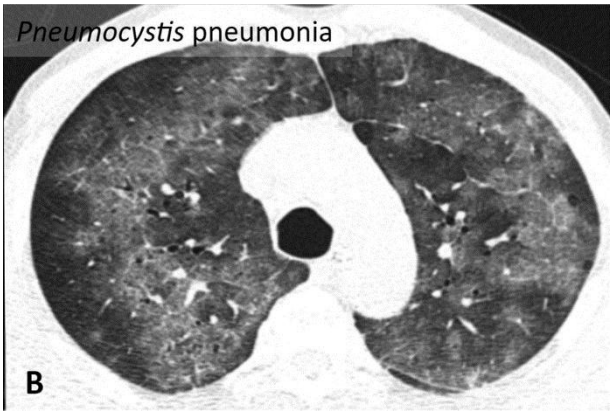


Figure 6: Unenhanced axial images patient secondary to acute lung injury from presumed Pneumocystis pneumonia (B).

3. Atypical appearance
It is defined as uncommonly or not reported features of Novel Coronavirus (COVID-19) pneumonia. Absence of typical or indeterminate features AND Presence of:
a) Isolated lobar or segmental consolidation without ground glass opacity

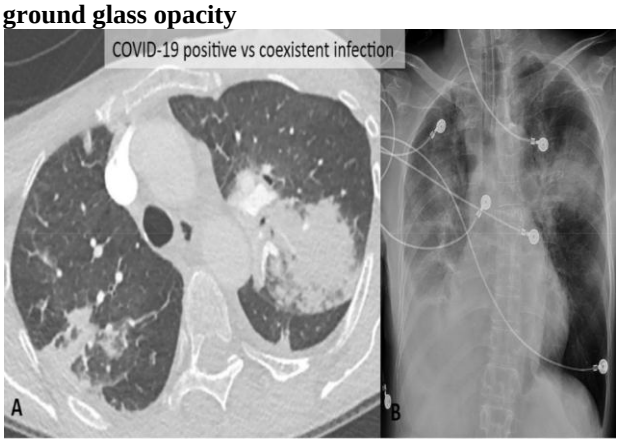


Figure 7: Contrast-Enhanced Axial Computed Tomography Image (A) And Frontal Chest Radiograph (B) Showing Segmental Consolidation Without Significant GGO.

b) Discrete small nodules (centrilobular, "tree- in-bud")

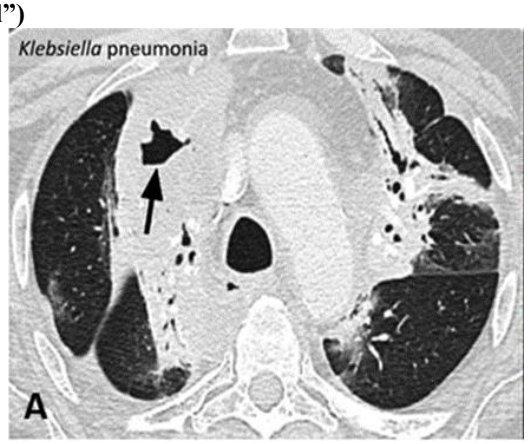


Figure 8: Axial images of the lungs of patients showing cavitation (arrow) in Klebsiella pneumonia.

c) Lung cavitation

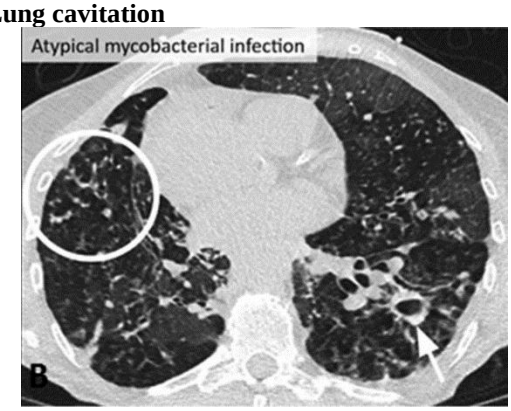


Figure 9: Axial images of the lungs of patient showing tree and bud opacities (circle) and a cavity (arrow) in nontuberculous mycobacterial infection.

4. Negative for pneumonia

It is defined as there is no features of pneumonia

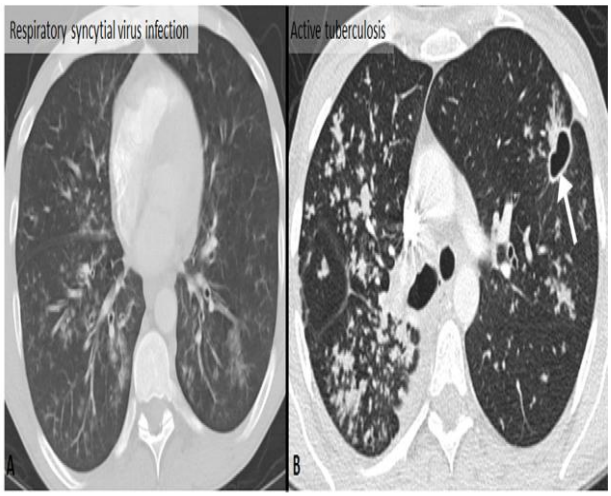


Figure 10: Axial images from two different patients showing tree-in-bud opacities and centrilobular nodules, caused by respiratory syncytial virus A) and active tuberculosis (B). A small cavity (arrow) is also present in (B)

CONCLUSION

The knowledge of the image features make the technologist / Physician to convey the presence, absence, or likelihood of COVID-19 when confronted with this as a specific indication. Standardized reporting can also provide guidance to physician as well as increased clarity to providers through reduced reporting variability. Providing unique identifiers for each of the category facilitates mining data for future research, educational, and quality improvement. Radiology reports combined with clinical assessment may also enable future care pathways to determine which patients may preferentially undergo RT-PCR should testing capacity be exceeded. Typical imaging findings may encourage repeat testing in the cases of initial RT-PCR tested negative patient.

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