Pulmonary COVID-19: Multimodality Imaging Examples

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Abbreviations: ARDS = acute respiratory distress syndrome, COVID-19 = coronavirus disease 2019, GGO = ground-glass opacity, RT-PCR = reverse transcriptase–polymerase chain reaction

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The full digital presentation is available online.

Coronavirus disease 2019 (COVID-19) emerged at the end of 2019, resulting in a global pandemic. As of August 4, 2020, 18.3 million confirmed cases and 695 874 confirmed deaths have been reported in the world, of which the United States experienced 4 750 578 cases and 156 594 deaths. COVID-19 is caused by a single-stranded RNA virus named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). COVID-19 is a member of the family of coronaviruses that includes zoonotic entities of SARS-CoV-2 and Middle East respiratory syndrome coronavirus (MERS-CoV). SARS-CoV-2 and MERS-CoV emerged in 2003 and 2012, respectively, and both lead to life-threatening pneumonia. Human coronaviruses designated HCoV-NL63, HCoV-229E, and HCoV-OC43 are also part of the coronavirus family and typically result in upper respiratory infections. COVID-19 primarily targets the lung, with patients presenting with pneumonia that can result in acute respiratory distress syndrome (ARDS). However, COVID-19 can result in multiorgan systemic disease, affecting the brain, gastrointestinal system, heart, and kidneys, either directly or indirectly through the host's inflammatory response and a hypercoagulable state.

Chest radiography, CT, and point-of-care lung US have important roles in the care of patients with COVID-19. A diagnosis of COVID-19 is confirmed by reverse transcriptase–polymerase chain reaction (RT-PCR). In patients with a positive RT-PCR test result with moderate or severe clinical features of COVID-19, chest imaging can be used to evaluate the baseline severity of any lung disease (Figs 1, 2). Imaging can be used to evaluate for alternative diagnoses in patients with a negative RT-PCR test result despite a persisting clinical suspicion for COVID-19. Multiple studies have described the chest CT findings of COVID-19. Reporting systems have been published that summarize the typical imaging findings and categorize those findings according to the level of suspicion. These systems can be applied to patients under investigation and to those with incidentally depicted findings. A standard approach for interpreting imaging findings within one's institution can enhance communication with health care providers and can be developed with knowledge of these reporting systems. Subsequent patient treatment is determined depending on the context of disease prevalence in the community and clinical features. In a low-prevalence scenario, a higher

TEACHING POINTS

- COVID-19 is diagnosed by using the RT-PCR test and can result in multiorgan systemic disease, ARDS, and a hypercoagulable state.
- At CT, COVID-19 typically manifests as peripheral GGOs that can be accompanied by consolidations, may be nodular in shape, and can contain a crazy-paving pattern.
- Point-of-care lung US is a modality that can aid in treatment of patients with COVID-19.

rate of false-positive examinations may ensue. In a high-prevalence scenario, a larger number of false-negative examinations, meaning more frequently atypical appearances for COVID-19, will probably be encountered. Chest radiography is shown to be less sensitive and specific than CT. Chest radiography is more readily available than CT, is easily performed, and can minimize in-hospital transmission. COVID-19 imaging findings at chest radiography correlate with chest CT findings. Point-of-care lung US performed by health care providers may aid in monitoring treatment response during hospitalization.

An awareness of the imaging findings of COVID-19 will aid in considering this entity when interpreting imaging studies. The objective of this online presentation is to provide a resource for understanding the imaging appearance of pulmonary manifestations of COVID-19 at multiple imaging modalities, including CT, chest radiography, and point-of-care lung US, as well as to highlight typical imaging findings and provide examples of differential diagnostic considerations and mimics.

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Suggested Readings

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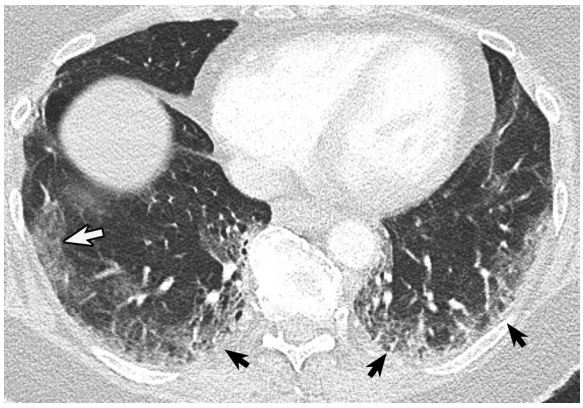

Figure 1. Peripheral ground-glass opacity (GGO) manifesting in a patient 5 days after symptoms of dyspnea, nausea, and body aches. Axial CT image shows faint rounded GGO (white arrow) in the right lower lobe laterally, with mild peripheral GGO in both lower lobes (black arrows).

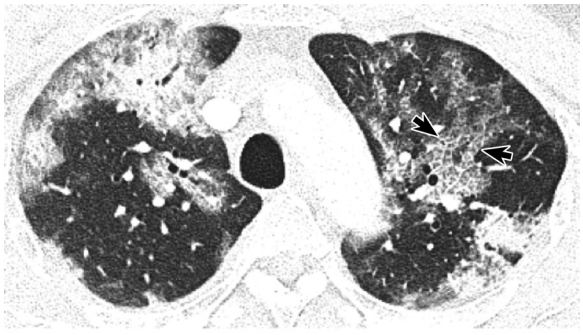

Figure 2. Crazy-paving pattern in the left upper lobe in a man with COVID-19. Axial CT image obtained 11 days after symptom onset shows intralobular lines within GGOs (arrows), which in combination with interlobular septal thickening create a cobblestone pattern characteristic of crazy paving.

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