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Imaging Patients With COVID 19: Current Perspective

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In early 2020, as the coronavirus disease (COVID-19) epidemic spread, numerous articles appeared on imaging for the diagnosis of COVID-19. Descriptions were often discordant and confusing because of small sample sizes and selection biases. Those discrepancies have been largely resolved. As clinical experience and testing improved, imaging’s role has largely switched from diagnosis to aiding prognosis and clinical management.

**Asymptomatic/mildly symptomatic patients:** The Fleischner Society (Radiology: Cardiothoracic Imaging, Vol. 2, No. 3) and others see no role for chest x-ray (CXR) or CT for diagnosis, unless comorbidities exist or testing is otherwise limited.

**Moderately/severely symptomatic patients:** CXR is often negative early, only to turn positive subsequently. The most characteristic findings are basilar and peripheral ground-glass opacities (GGOs) (Fig. 1).

Unfortunately, only a minority of patients have this typical COVID-19 pattern. In most patients, the disease is located more diffusely or elsewhere. Consolidation may be present initially with more severe illness or duration (Fig. 2).

Early on, CT may be positive when the CXR is negative. The typical GGO distribution is similar, but usually more extensive than on CXR (Fig. 3).

Adenopathy, cavitation, and effusion are uncommon early on. Compared to other viral pneumonias, peripheral lower-lobe GGOs are more common in COVID-19, while other pneumonias tend to have more diffuse disease. There is considerable overlap, however.

**Reporting guidelines:** Many templates have been proposed. Radiological Society of North America guidelines (Radiology: Cardiothoracic Imaging, Vol. 2, No. 2) define:

- **CXR** = negative, COVID-19-like; regular pneumonia, other disease
- **CT** = negative, typical of COVID-19; indeterminant, not COVID-19

Both show moderate interobserver reproducibility.

**Follow-up of established disease:** On CXR and CT, GGOs and focal area of consolidation often progress and may evolve into a bilateral acute respiratory distress syndrome-like pattern when cytokine storm develops. Less common CT findings continue on page 2
ings include dilated peripheral pulmonary vessels, adenopathy, rounded infiltrates, and signs of bronchial inflammation. Hospital-acquired bacterial pneumonia may complicate COVID-19 and vice versa. Pre-existing lung disease (e.g., chronic obstructive pulmonary disease, interstitial lung disease, etc.) further complicate interpretation. Clearing usually starts after 2 weeks. COVID-19 may cause hypercoagulability, leading to an increased incidence of both emboli and in situ thrombi and deep vein thrombosis.

Pleural effusions may appear late, and barotrauma causing pneumothorax appears to be more common than in other viral pneumonias.

Beyond the thorax: COVID-19 affects more than the lung. It is now clear that this is a systemic disorder affecting many organs. As with lung involvement, patients with comorbidities (e.g., diabetes, cardiopulmonary disease, etc.) appear more likely to develop extrapulmonary diseases—summarized briefly below:

Cardiac disease: A significant minority of patients develop cardiac disease, evidenced by elevated troponins and other cardiac markers. Imaging may show evidence of heart failure, myocarditis, coronary vasculitis, mural thrombi, and pericardial effusions. Cardiac MRI has an important role, since it can identify myocardial inflammation. Myocarditis has been associated with poor outcomes, including cardiac dysfunction and mortality (either related to COVID-19 or other cause).

Neurological disease: Approximately 15–20% of hospitalized patients develop mental status or more focal symptoms. Imaging is positive in a minority, however. Ischemic infarcts are the most common imaging findings, probably related to coagulopathy. Reported infrequently are hemorrhagic stroke, cranial nerve inflammation, encephalopathy, and worsening of multiple sclerosis plaques.

Renal disease: Elevated renal function tests are not uncommon, and acute renal failure has been reported in some cytokine storm patients. Ultrasound may show increased renal echogenicity.

Gastrointestinal disease: Diarrhea and other gastrointestinal symptoms are not uncommon. Imaging may show ileus, dilatation, bowel loops (diffuse/focal), and CT may reveal contrast-enhanced bowel wall. Liver function tests are often abnormal, but failure is uncommon.

Long haulers: Perhaps 10–15% of patients have residual vague or specific symptoms. Cough and dyspnea are frequent and usually clear with supportive therapy within 30 days. Imaging is suggested for symptoms lasting beyond 30 days. Apparent “fibrosis” may clear with time. Signs and symptoms in other organ systems may also linger. Clinical and imaging understanding are still evolving and may change as second- and third-wave infections hit, mutations occur, and vaccines are deployed. Stay tuned!
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- **May 1–6, 2022**
  - Hyatt Regency, New Orleans, LA
- **May 7–12, 2023**
  - Marriott Wardman Park Hotel
  - Washington, DC

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**Radiology and Diagnostic Imaging**

**Across**

7. MRI is most valuable for images of the heart, large blood vessels, ______, and soft tissues
8. Patients with implanted metal devices such as _____, wires, clips, or prosthetic valves are not eligible for MRIs
9. PET scans provide color-coded images that indicate the degree and intensity of the _____ process
10. During an ultrasound, sound waves are reflected back into the _____

**Down**

1. X-rays use high-energy _____ waves
2. ______ ______ declared he was scared of X-rays
3. Recent *AJR* research suggests that shielding is not recommended for testicles and ovaries to prevent ______-induced abnormalities
4. Mammography is the method for screening for breast ______
5. Radiologist: A medical doctor who specializes in ______
6. A CT scan is a two-dimensional view of ______ being evaluated