

## Pulmonary and Extra Pulmonary Manifestations of COVID-19

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### Abstract

### Review Article

Global public health emergency: COVID-19, triggered by SARS-CoV-2. A thorough search was conducted using Web of Science, PubMed, and Scopus databases, and 36 relevant studies were identified. COVID-19 has spread to over 200 nations, causing 14 million infections as of July 18, 2020. SARS-CoV-2 affects more than only the respiratory system, causing fever, cough, and dyspnea. COVID-19 extrapulmonary symptoms are little documented [1]. This study covers COVID-19's cardiovascular and neurological symptoms. COVID-19's clinical characteristics will be compared to SARS and MERS. The goal is to raise knowledge of the organ systems impacted by SARS-CoV-2 and explain the clinical similarities and distinctions of these disorders. COVID-19 patients also have arrhythmias. COVID-19 individuals also experience gastrointestinal problems. These symptoms include moderate diarrhea to severe vomiting and abdominal discomfort. COVID-19 has pulmonary and extrapulmonary symptoms. The most prevalent symptoms are pulmonary (ARDS, pneumonia, and respiratory failure) and extrapulmonary (cardiovascular and gastrointestinal). Understanding these symptoms helps physicians treat COVID-19 patients [2]. COVID-19 causes pneumonia, ARDS, and respiratory failure. Severe COVID-19 can lead to ARDS. Lung inflammation causes fluid collection and respiratory problems. X-rays and CT scans can detect COVID-19-related pneumonia. Severe COVID-19 patients often have a respiratory failure when their lungs cannot provide adequate oxygen.

**Keywords:** COVID-19, Comorbidity, Cardiovascular disease.

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## INTRODUCTION

The coronavirus family has generated many highly virulent worldwide epidemics in the past two decades, notably the 2003 SARS-CoV-1 outbreak in China and the 2012 MERS-CoV outbreak in Saudi Arabia. COVID-19, caused by the SARS coronavirus-2, began in December 2019 in China (SARS-CoV-2). COVID-19 mostly affects the lungs and can cause respiratory discomfort and mortality [3]. However, extrapulmonary organs and systems can also be damaged, including the cardiac, gastrointestinal, hepatic, renal, ophthalmic, and dermatologic systems.

COVID-19 is a respiratory illness caused by the novel coronavirus SARS-CoV-2, which has profoundly impacted global health since its emergence in late 2019. While the primary mode of transmission is through the respiratory tract, COVID-19 has been associated with a range of pulmonary and extrapulmonary manifestations, including acute respiratory distress syndrome (ARDS), pneumonia, respiratory failure, cardiovascular complications, and gastrointestinal symptoms [4].

The clinical presentation of COVID-19 can vary widely, with some patients presenting with mild symptoms and others developing severe disease requiring hospitalization and intensive care (3). Understanding the diverse range of manifestations of COVID-19 is crucial in the management of the disease and can inform treatment decisions for individual patients [5].

This review paper will provide a comprehensive overview of the pulmonary and extrapulmonary manifestations of COVID-19. We will examine the epidemiology, clinical presentation, and diagnostic methods for each of these manifestations. We will also discuss these manifestations' underlying mechanisms and pathophysiology and their potential implications for patient management.

Our review will draw upon various sources, including recent literature on COVID-19 and related respiratory illnesses, as well as clinical practice guidelines from reputable organizations such as the World Health Organization and the Centers for Disease Control and Prevention. By synthesizing the current

state of knowledge on the pulmonary and extrapulmonary manifestations of COVID-19, we hope to provide valuable insights for clinicians and researchers working to combat this disease [6].

### COVID-19 Cardiorespiratory Manifestation

COVID-19 cardiac symptoms are documented in the literature. Cardiac arrhythmias, myocarditis, pericarditis, acute coronary syndrome, heart failure, cardiogenic shock, and cardiac arrest are all possible outcomes of infection with COVID-19. Patients with preexisting cardiovascular illness are more likely to experience these cardiac symptoms, and their chance of acquiring severe COVID-19 is also increased [7].

Patients admitted to the intensive care unit (ICU) were more likely to have hypertension, cardiovascular disease, and diabetes mellitus, according to a meta-analysis of COVID-19 patients. As evaluated by increases in Troponin I/T or CK, acute cardiac damage was also more likely in severe/ICU COVID-19 patients compared to those not admitted to the intensive care unit. Higher in-hospital death rates have been linked to cardiovascular disease and myocardial damage in COVID-19 patients [8]. Cardiovascular disease (CVD) is not more common in COVID-19 individuals than in the general population, but the virus can worsen preexisting CVD and cause catastrophic cardiac consequences. Therefore, monitoring and properly managing COVID-19 patients' cardiovascular health closely is essential. It can cause major difficulties and even death, especially in people with cardiovascular disease.

COVID-19 can affect various organs, including the heart. Several cardiac manifestations have been reported in COVID-19 patients, with varying incidences. Cardiac arrhythmias are the most commonly reported cardiac manifestation, with an incidence of 16.7%. Myocarditis and acute coronary syndrome are less common, with reported incidences of 7.2% and 1.8-18.5%, respectively. Pericarditis can also occur, with reported incidences ranging from 0.2% to 8.9%. Heart failure is a serious complication of COVID-19, with reported incidences ranging from 23.8% to 52%. Cardiogenic shock, a condition where the heart fails to

pump enough blood to meet the body's needs, has been reported in 2.5-7.2% of COVID-19 patients. In some cases, cardiac arrest, a sudden loss of heart function, has also been reported, ranging from 1.4% to 3.6% [9]. It is important to monitor COVID-19 patients for these cardiac manifestations, as they can significantly affect the course of the disease and the patient's overall prognosis.

### SARS-Cov-2 Neurological Manifestations

The respiratory system is the primary target of SARS-CoV-2, the virus responsible for COVID-19; nevertheless, the virus has also been linked to various neurological symptoms. These neurological symptoms are becoming more of a focus of attention because of their potential impact on patient outcomes and treatment [10].

SARS-CoV-2 can have both direct and indirect effects on the neurological system, including invasion of the brain and inflammation/vascular damage. Anosmia (loss of smell) and ageusia (loss of taste) are the most often reported neurological signs of COVID-19; however, headache, dizziness, confusion, and seizures have also been observed [11]. There is growing evidence that COVID-19 can have long-term neurological consequences in addition to these acute symptoms. A recent study, for instance, indicated that COVID-19 patients had an elevated risk of acquiring neurological and behavioral illnesses for up to six months following the beginning of symptoms [10].

Evidence suggests that SARS-CoV-2 may induce inflammation and damage to blood vessels, resulting in reduced blood flow and oxygen delivery to the brain; however, the processes behind these neurological symptoms are currently being explored [12]. Various neurological problems, such as stroke and encephalitis, can develop from this.

In general, more information is needed about how COVID-19 might show itself in the nervous system. Clinicians treating patients with COVID-19 should be alert to and prepared for these possible signs and symptoms.

**Table 1: Studies of COVID-19's neurological issues in comparison groups**

Study	Sample size	Neurological manifestations reported
Mao <i>et al.</i> , [10]	214	Confusion, headache, dizziness, impaired consciousness
Helms <i>et al.</i> , [13]	58	Delirium, encephalopathy, focal neurological deficits
Paterson <i>et al.</i> , [14]	125	Stroke
Tsai <i>et al.</i> , [3]	221	Myalgia, headache, anosmia, ageusia
Ellul <i>et al.</i> , [15]	153	Encephalopathy, seizures, stroke, Guillain-Barré syndrome
Frontera <i>et al.</i> , [16]	927	Delirium, coma, stroke, seizures, encephalitis, meningitis, myelitis

**Table 2: Recent Systematic Reviews of COVID-19 Pulmonary Manifestations**

Meta-analysis	Number of studies included	Key findings
Yang <i>et al.</i> , [17]	21	Higher incidence of ground-glass opacities and consolidation on chest CT scans in severe cases of COVID-19.
Kanne <i>et al.</i> , [18]	28	Predominant chest CT findings include ground-glass opacities, consolidation, and crazy paving pattern.
Salehi <i>et al.</i> , [19]	46	Common CT findings in COVID-19 patients include ground-glass opacities, consolidation, and interlobular septal thickening.
Caruso <i>et al.</i> , [20]	24	Chest CT abnormalities are present in most COVID-19 patients, with the most common findings being ground-glass opacities, consolidation, and crazy paving pattern.
Li <i>et al.</i> , [21]	31	Higher incidence of bilateral lung involvement and ground-glass opacities on chest CT scans in severe cases of COVID-19.

**Analyzing Respiratory Symptoms Caused by CoV-19, SARS, and MERS**

Varied coronavirus strains produce distinct degrees of illness and different clinical presentations, such as COVID-19, SARS, and MERS. The lung is often the first and most noticeable organ to show signs of chronic illnesses.

Respiratory symptoms and radiological results are quite similar to COVID-19 and SARS. Bilateral ground-glass opacities and consolidation are frequently found on chest CT scans of patients with both illnesses, which can induce fever, cough, and dyspnea [22]. In contrast to SARS's quick advancement and high death rate, COVID-19 may have a longer course and may cause the development of acute respiratory distress

syndrome (ARDS) in severe instances. Compared to COVID-19 and SARS, the pattern of pulmonary involvement is distinct in MERS. Severe pneumonia caused by MERS frequently involves a peripheral distribution but can be localized or segmental. Multifocal ground-glass opacities, consolidation, and pleural effusions may be seen on chest CT scans of individuals with MERS [23].

There are numerous parallels between COVID-19 and SARS regarding pulmonary symptoms, but MERS has a unique pattern of pulmonary involvement. Accurate diagnosis, suitable therapy, and effective infection control depend on familiarity with these distinctions.

**Table 3: The similarities and differences between the SARS, MERS, and COVID-19 coronavirus pandemic [24, 25].**

Disease	First Outbreak	Countries Affected	Case Fatality Rate (%)	Transmission Rate	Common Symptoms
SARS	November 2003	29	9.6	Human-to-human	Fever, cough, dyspnea
MERS	September 2012	27	34.4	Zoonotic (camel-to-human)	Fever, cough, dyspnea, gastrointestinal symptoms
COVID-19	December 2019	222	1-3 (global average)	Human-to-human (airborne)	Fever, cough, dyspnea, fatigue

This study includes focuses on the non-pulmonary symptoms of COVID-19, which can affect a variety of organ systems. Cardiovascular symptoms are prevalent and are related with higher death rates. These include myocarditis, acute coronary syndrome, and cardiac arrest. Patients already suffering from cardiovascular disease are more likely to get severe COVID-19 symptoms. COVID-19 has also been linked to dermatological and ophthalmic symptoms and those in the nervous system, the kidneys, and the gastrointestinal tract.

In addition to that, the review covered the topic of the prevalence of asymptomatic COVID-19 infections. Even while some cases of asymptomatic infections may advance to symptomatic disease, most cases do not proceed to severe illness. However, even

those without symptoms can spread the virus to others, which highlights the need to test and track down any infected person's contacts.

**CONCLUSION**

Patients with preexisting comorbidities such as heart disease, diabetes mellitus, chronic obstructive pulmonary disease (COPD), cancer, chronic renal disease, hypertension, ischemic heart disease, congestive heart failure, asthma, and cerebrovascular accident (CVA) are at a higher risk for severe disease and worse health outcomes when infected with respiratory viruses such as COVID-19, MERS, and SARS. Previous studies have shown that patients with SARS and MERS who had comorbidities generally experienced poorer health outcomes, and this trend has continued with COVID-19. Patients with COVID-19

with underlying COPD, hypertension, and cardiovascular disease are at a greater risk of requiring ICU admission or experiencing severe disease. Therefore, healthcare professionals need to identify and monitor patients with comorbidities closely and take steps to minimize their risk of exposure to respiratory viruses. Additionally, further research is needed to understand better the relationship between comorbidities and respiratory viruses and the mechanisms behind their increased risk for severe disease.

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