WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 11, Issue 7, 1001-1012. Review Article ISSN 2277– 7105

A REVIEW ON POST COVID-19 COMPLICATIONS

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Article Received on
17 April 2022,

Revised on 07 May 2022,
Accepted on 27 May 2022

DOI: 10.20959/wjpr20227-24381

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ABSTRACT

In December 2019, the first case of coronavirus disease (COVID-19) was reported from Wuhan, (china). Covid-19 is a dangerous virus strain that quickly spread over the world with almost 150 million infections characterized by fever, dry cough, interstitial pneumonia, drowsiness, headache, and loss of flavor and aroma, COVID-19 has created enormous problems in the twenty-first century, and the world health organization declared it a pandemic. This pandemic has taken a significant toll on the global healthcare sector, with lockdowns in several countries. Recent vaccination programs have provided promise, and numerous countries, notably Israel, the United Kingdom, and the United States, have pioneered vaccine distribution. According to previous research, many complications have been detected in people who get affected to the Covid-19, which include cardiological, pulmonary, gastrointestinal, neurological, psychological, rheumatological, and hematological. So, health care providers, as well as the public, should be aware of these severe complications of Covid-19.

KEYWORDS: Covid 19, Wuhan, China, Coronavirus.

1. INTRODUCTION

The coronavirus disease 2019 (covid-19) produced by the severe acute respiratory syndrome coronavirus 2 (SARS COV-2) has swiftly progressed from an epidemic outbreak in china[1] to a pandemic affecting over 1 million people worldwide. COVID-19 is primarily manifested as a respiratory tract infection, but new evidence suggests that it should be considered a systemic disease affecting numerous systems, including the cardiovascular, respiratory, gastrointestinal, neurological, hematopoietic, and immunological systems.[2-4] Recent immunological research has added to the evidence that the "cytokine storm" is caused by the enormous synthesis and release of pro-inflammatory cytokines. This can trigger a damaging immunological response, which can lead to ARDS and multi-organ dysfunction syndrome (MODS).[5,6] The activation of coagulation pathways during the immunological response to infection causes an imbalance between pro-and anticoagulant factors, resulting in micro thrombosis, disseminated intravascular coagulation, and multiorgan failure.[7] Chest discomfort, dyspnea, dysrhythmia, and abrupt left ventricular failure are all symptoms of covid-19. Acute myocarditis presents with a wide range of clinical severity and poses a considerable diagnostic difficulty. In severe coronavirus infections, neuropsychiatric and psychological symptoms have been recorded rarely. However severe neurological and neuropsychiatric manifestations linked to covid-19 are becoming more common, including a patient with encephalitis in china who had SARS-CoV-2 in his CSF, a patient with necrotizing encephalopathy in Japan, and cases of cerebrovascular illness. Taking these many severe complications into consideration we aimed to give a quick summary to health care professionals and also to the general public.

2. METHODOLOGY

The data in this review article was collected from the previously reported research articles and scholarly articles on covid-19 complications and some Chinese databases. Furthermore, this platform continues to be one of the world's largest indexing and summary databases, with peer-reviewed scientific information. Data was searched by using terms like ‘Wuhan covid virus’, ‘corona virus’, ‘complications of covid-19’, ‘post-Covid complications’, ‘neurological complications due to covid’, ‘post covid cardiovascular complications’, ‘post covid pulmonary complications’, ‘post covid immunological complications’, ‘mental and physical complications due to covid-19’, ‘Cerebrovascular complications’, ‘sars cov-2’, ‘gastrointestinal complications’, heart failure, bronchial asthma, myocardial infarction, rheumatoid arthritis, ischemic stroke, PAH, etc:- The keywords were chosen from pre-

published review articles on post-covid disorders, and all of the terms were chosen based on the fact that they were in the titles, abstracts, and keywords of the documents. The references were chosen from documents published in the last two years that contained information on COVID-19-related short- and long-term harmful effects.

3. RESULTS

3(a) Cardiovascular complications – Recent research has suggested that the virus may also cause direct damage to the heart utilizing ACE2 receptors located within cardiac tissue.[16] Hypertension was found to be 17.1% and heart disease was 16.4% in a meta-analysis of 1527 patients with COVID-19, and these patients were more likely to require critical care.[17] Another study on COVID-19 patients indicated that a history of CVD was linked to a nearly five-fold increase in the case of fatality rate (10.5 percent vs. 2.3 percent).[18]

Targeted organ	Complications	Possible causes	Detected by
heart	Myocardial injury and myocarditis	Increased cardiac physiological stress, hypoxia, or direct myocardial injury[19,20]	Elevated troponin levels, high viral loads, autopsy.
	Acute myocardial infarction	Extensive inflammation and hypercoagulability,	Physical examination, ecg changes
	Dysrhythmias	Hypoperfusion, fever, hypoxia, anxiety[18]	Palpitations and elevated serum troponin
	Venous thromboembolic event	Systemic inflammation, abnormal coagulation	Elevated d-dimer computed tomography pulmonary angiography

3(b) Neurological effects: Direct damage to particular receptors, cytokine-related injury, secondary hypoxia, and retrograde travel along nerve fibers are some of the methods by which SARS-CoV-2 produces neurologic damage.[21,22] Angiotensin-converting enzyme 2 (ACE2) expression on blood-brain barrier endothelial cells, like that on lung epithelial cells, can facilitate viral attachment at this critical point, allowing viral entrance into the central nervous system by targeting the vasculature.[23,24] IL-12, IL-15, and tumor necrosis factor alpha (TNF) activate gial cells and cause a widespread pro-inflammatory state in the central nervous system.[25] When these systemic effects are paired with localized lung alveolar injury, severe hypoxia occurs, which can lead to cerebral vasodilation. IL-6 levels, in particular, have been linked to greater disease severity in covid-19.

Targeted organ	Complications	Possible causes	Detected by
Brain and nervous system	Acute cerebrovascular disease	Global inflammatory response and hypercoagulable state	Elevated d-dimer
	Encephalitis and encephalopathy	Cytokine storm, the pathophysiology is unclear but may be related to edema secondary to inflammatory injury versus direct viral infection.	Physical signs and imaging screenings
	Hemophagocytic lymphohistiocytosis	Hlh is a dysregulation of t-lymphocyte' and macrophage over-activation caused due to the immunosuppression by the coronavirus	Hlh patients show intermittent fevers, pancytopenia, coagulopathy, hepatic dysfunction, hypertriglyceridemia, and an elevated ferritin

3(c) Haematological and Vascular related complications: Most of the post covid hematological compilations are due to the blood coagulability. Previous articles state that most hospitalized covid patients commonly showed hypercoagulability. Elevated D-dimer levels are frequently observed, and their progressive increase over time is strongly linked to disease progression. Other coagulation abnormalities, such as prolonged PT and APTT times, increased fibrin breakdown products, and severe thrombocytopenia, can lead to life-threatening disseminated intravascular coagulation (DIC),[26] which requires constant monitoring and quick management. COVID-19 infected patients, whether hospitalized or ambulatory, are at high risk for venous thromboembolism. Finally, the importance of ensuring blood donations during the pandemic is emphasized. In severe or critically ill patients, the production of a substantial number of inflammatory mediators, as well as the administration of hormones and immunoglobulins, can result in an increase in blood viscosity.

Targeted organ	Complications	Possible causes	Detected by
Blood and blood vessels	Venous thromboembolism	• Long term immobilization due to illness • dehydration • An acute inflammatory	• Elevated d- dimer levels • imaging tests • Echocardiography • Physical signs

		state • the presence of other cardiovascular diseases or • Previous history of vte	
	Deep vein thrombosis	• Prolonged immobilization • Previous surgeries	• Elevated d-dimer • Imaging tests like ct, ultrasonography, ecg, mri. • Physical symptoms
	Pulmonary embolism	• Thrombolysis • Trauma	• Physical signs and symptoms • Ecg changes

3(d) – Rheumatological and Autoimmune complications: Coronaviruses are more commonly associated with arthralgia and myalgia than with genuine inflammatory arthritis.[27] Arthralgia has been recorded in 15% of COVID-19 patients, while myalgia has been documented in 44% of patients.[28,29] Infections of the respiratory tract have also been linked to an increase in the frequency of cases of rheumatoid arthritis (RA)[30] Following SARS-CoV-2 infection, literature searches showed a few cases of reactive arthritis, five cases of RA, and two cases of seronegative spondyloarthropathy.[27]

Targeted organ	Complications	Possible causes	Detected by
Bones and joints	Inflammatory arthritis	Immunological alterations Abnormal cytokinin production	Rheumatoid factor positivity Cyclic citrullinated peptide (ccp) positivity
Multi-organ inflammation	Systemic lupus erythematosus	Due to the dysregulated cytokinin response the pro-inflammatory mediators trigger the immune system and produce antibodies	Positive apl antibodies Lac +,
Blood vessels	Vasculitis	Due to the accumulation of polyclonal antigen-antibody immune complexes make more hypersensitive	Macro and microvascular damage Hemorrhages Altered blood

		and may lead to vasculitis	pressure High wbc count

3(e)-Renal complications: SARS-CoV-2 enters human lung cells via binding to angiotensin-converting enzyme 2 (ACE2). The extensive distribution of ACE2 in the body has been connected to SARS-multiorgan CoV-2's involvement. ACE2 expression is highest in the ileum and kidneys. ACE2 is expressed on various cells in the kidney, including mesangial cells, podocytes, Bowman's Capsule parietal epithelium, and collecting ducts.[31] Although the processes underlying COVID-19's renal symptoms remain unknown, a complex multifactorial pathway has been hypothesized, which involves the following:

1. Direct viral replication in the kidneys, resulting in impairment.[32]
2. Local disruption in renin-angiotensin-aldosterone system (RAAS) homeostasis.[32]
3. Lung-protective fluid management approach during treatment of ARDS.[33]
4. As a result of a systemic inflammatory reaction "cytokine storm"

Targeted organ	Complications	Possible causes	Detected by
Kidneys	Acute kidney injury	• Direct viral replication in the kidneys, resulting in impairment • As a result of a systemic inflammatory reaction “cytokine strom”	• Pedal edema • Decreased urine output • Renal function test • Glomerular filtration rate • Urine analysis
	Electrolyte imbalance	• Direct viral replication in the kidneys, resulting in impairment	• Serum electrolytes • Ecg changes • Physical signs and symptoms

3(f) –Gastrointestinal complications: According to the study by Haytham M. et al., Patients with coronavirus illness have also developed extrapulmonary diseases. The gastrointestinal (GI) issues of COVID-19 patients hospitalized in the intensive care unit are described. Hepatobiliary, hypomotility, bowel ischemia, and other GI problems were divided into four categories. Transaminitis was the most prevalent of the hepatobiliary consequences (67 percent). Hypomotility-related problems occurred in half of the patients, with varying degrees

of severity. Only a few patients with severe ileus had clinical and radiologic symptoms that suggested intestinal ischemia, and they were rushed to the operating room.[34]

Targeted organ	Complications	Possible causes	Detected by
Gastrointestinal system	Patchy bowel necrosis	• Microvascular thrombosis due to hypercoagulability	• Ct imaging test • D-dimer
	Bowel ischemia	• Due to the formation of thrombosis in the blood vessels, the blood flow to the bowel and organs were blocked resulting in the oxygen demand	• Physical signs and symptoms • Ct imaging tests • Altered gi motility
	Liver ischemia and necrosis	• Due to the thrombosis the blood supply to the hepatic system blocks	• Ct scan • Usg abdomen

3(g) Obesity: During the covid-19 pandemic, most countries implemented lockdowns and curfews. As a result, the majority of folks stayed at home and ate a lot of protein meals. The majority of polls found that people's weight had grown before the epidemic compared to after the covid-19 pandemic. Obesity caused by covid can take numerous forms. It could be stress-related obesity or diet-related obesity.

3(h) Respiratory complications: The prevalence and severity of covid-19 infection's long-term respiratory problems are unknown, but new evidence suggests that many patients have chronic respiratory symptoms months after their first sickness.[34] The NHS recently released guidance that outlines the expected post-covid-19 care needs of patients and identifies potential respiratory issues including chronic cough, fibrotic lung disease, bronchiectasis, and pulmonary vascular disease. After their acute sickness, roughly 30% of those with SARS or Middle East respiratory syndrome experienced persistent lung abnormalities, according to reports.[35]

Targeted organ	Complications	Possible causes	Detected by
Lungs	Pulmonary fibrosis	Viral pneumonia	• High inflammation markers • Elevated lactate dehydrogenase • C-reactive protein
	Pulmonary embolism	Due to thrombosis of deeper veins	• Ct pulmonary angiogram
	Bronchiectasis	It could be as a result of the sickness or as a result of a secondary bacterial infection.[36]	
	Pneumothorax	Maybe it can be related to the destruction of alveolar walls by corona induced inflammation	• Imaging tests • Signs and symptoms
	Acute bronchitis	Inflammation of bronchioles by the virus induced release of pro inflammatory mediators like cytokines	• Chest x-ray • Ct

4. CONCLUSION

COVID-19 is still a worldwide problem. Despite the excellent news that millions of individuals are receiving safe and effective vaccines on a daily basis, the novel coronavirus will continue to spread until worldwide herd immunity is achieved, which might take a long time. COVID-19 disease presents itself in a variety of body systems, including the cardiovascular system, nervous system, hemopoietic system, rheumatological system, gastrointestinal system, immunological system, and others, all of which have varying degrees of significance. Laboratory values can help clinicians formulate a personalized treatment approach and quickly give intense care to those who are in higher need by evaluating them at baseline and during the disease course. Preventive interventions and early detection of potentially fatal consequences in order to intervene effectively will likely improve patient

outcomes and lower the death rate overall and among infected individuals with no substantial comorbidities.

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