



Post Covid 19 Care: Suggestive Tests and Scans

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ABSTRACT

The COVID 19 virus can leave long-lasting, lingering side effects even after the viral load has depleted. Most of the people they get better within few weeks. But in some people, especially those who got critically ill, needed to stay in the ICU, be put on a ventilator, or have other types of breathing support, in them the virus can impact many vital organs of the body, either directly or sometimes very badly hamper immune response. So, special precautions, some tests and scans might be worth taking it. Our study adds some novelty about the identification of effective biomarkers of progressive disease, and which might be helpful for diagnosis, prevention of complications, and effective therapy.

Keywords: COVID 19, CBC test, Chest scan, CRP protein, D- dimer.

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INTRODUCTION

COVID 19 occur mainly through close-range *i.e.*, contact (within approximately six feet or two meters) via respiratory particles; virus released in the respiratory secretions when a person with infection coughs, sneezes, or talks can infect another person if it is inhaled or makes direct contact with the mucous membranes. Infection might also occur if a person's hands are contaminated by these secretions or by touching contaminated surfaces, and then they touch their eyes, nose, or mouth, although contaminated surfaces are not thought to be a major route of transmission¹. COVID 19 can also be transmitted longer distances through the airborne route (through inhalation of particles that remain in the air over time and distance), but the extent to which this mode of transmission has contributed to the pandemic is unclear².

Common cases of COVID-19 infection were defined as those who had a fever, respiratory tract symptoms, and pneumonia on imaging. Severe cases were those who had one of the following three clinical manifestations:

- (a) Shortness of breath with a respiratory rate greater than 30 breaths/min,
- (b) Mean oxygen saturation \leq 93% in the resting state, and

(c) Partial pressure of arterial oxygen/oxygen concentration \leq 300 mm Hg.

Severe cases also included the progress of lesions by more than 50% within 24 to 48 hours, as detected by pulmonary imaging. The incubation period for COVID19 is thought to be within 14 days following exposure, with most cases occurring approximately three to five days after exposure. The incubation period also varies by viral variant. For example, the incubation period for the Omicron variant (B.1.1.159) appears to be slightly shorter than other variants.

COVID 19 Variants^{3,4}

Multiple variants are circulating globally. Some variants contain mutations in the surface spike protein, which mediates viral attachment to human cells and is a target for natural and vaccine-induced immunity. Thus, these variants have the potential to be more transmissible, cause more severe disease, and/or evade natural or vaccine-induced immune responses. Some of the more important circulating variants are:

Alpha (B.1.1.7 lineage), also known as 20I/501Y.V1, was first identified in the United Kingdom in late 2020. This variant is estimated to be more transmissible than wild-type virus. Some studies suggest this variant may cause more severe illness.

Delta (B.1.617.2 lineage), also known as 20A/S:478K, was identified in late 2020 in India. This variant is more transmissible than B.1.1.7 and is also associated with more severe disease.

Omicron (B.1.1.529 lineage) was first reported from Southern Africa in November 2021, and it was promptly identified in multiple other countries. The variant contains >30 mutations in the spike protein, including mutations



that have been found in other variants of concern and that have been associated with increased transmissibility and decreased susceptibility to neutralizing antibodies (including therapeutic monoclonal antibodies). Emerging data suggest that Omicron has a replication advantage over the Delta variant and evades infection- and vaccine-induced humoral immunity to a greater extent than prior variants. The risk of severe disease with the Omicron variant is more uncertain.

Stages of illness and recovery ^{5,6}

Acute COVID conditions– This refers to symptoms lasting up to 4 weeks after a person is infected. Most people with mild COVID-19 do not have symptoms beyond this stage, but some do.

Post-COVID conditions – This refers to symptoms that continue beyond 3 months after being infected. This is more common in people who were critically ill. Critically ill means they needed to stay in the intensive care unit ("ICU"), be put on a ventilator (breathing machine), or have other types of breathing support.

Suggestive Tests and Scans ^{7,8}

Complete Blood Count (CBC) tests

CBC tests are a fundamental test that measures the different types of blood cells (RBCs, WBCs and Platelets etc) and gives you an idea of how well the body of the patient has responded to a COVID 19 infection. It could also, in a way, guide you surely to take additional measures that you may need to take post-recovery.

Platelet count

In COVID 19 infection, the presence of thrombocytopenia correlates with the severity of the disease. Platelet number was found to be lower in patients with either more severe illness or poor outcomes. The mechanism by which the COVID 19 interferes with the haematopoietic system is still unclear. Three mechanisms of a cascade can be assumed to explain thrombocytopenia in COVID 19 infections:

- 1) Direct infection of bone marrow cells by the virus with inhibition of PLT synthesis;
- 2) Destruction of PLTs by the immune system;
- 3) Aggregation of PLTs in the lung.

Lymphocytes

The best recognized haematological abnormality in patients affected by COVID 19 infection is lymphopenia, which is seen in up to 85% of severe cases with the severity of lymphopenia linked to outcome. The presence of lymphopenia (defined by an absolute number of lymphocytes $< 1.0 \times 10^9/L$) is reported in most of the published series and is commonly considered to be a deficient immunological response to viral infection. It is well known that alteration in total lymphocyte numbers and the subsets varies with different virus types, indicating

a potential association between lymphocyte subset alteration and viral pathogenic mechanisms. Lymphopenia might be caused by virus attachment or indirectly by immune injuries from inflammatory mediators. Moreover, exudation of circulating lymphocytes into inflammatory lung tissues might also lead to lymphopenia. The reduction of lymphocyte subset count in COVID-19 patients was investigated across 20 peer-reviewed studies for reporting lymphocyte subset counts and COVID-19 disease severity. CD4+ T cell, CD8+ T cell, B cell, Natural killer (NK) cell, and total lymphocyte cell counts all showed a statistically significant reduction in patients with severe/critical COVID-19 disease compared to mild/moderate disease.^{9,10}

Leukocytes and Neutrophils

Significantly leukocytes and neutrophils count is higher in severe than in non-severe COVID 19 infected patients. Further, along with COVID 19 disease progression, both leukocyte and neutrophil counts increased in the severe group. The increase of neutrophils has been reported not only in the bloodstream but also in the lung tissue. The increased infiltration of immature and/or dysfunctional neutrophils contributes to the abnormal lung's immune response in severe patients.

Risk for blood clots due to COVID 19 ¹¹

Most cases of blood clots in people with COVID19 have been reported in individuals who've been hospitalized. A study Trusted Source of more than 300 people hospitalized with COVID-19 found that high D-dimer levels were a strong predictor of death. **Other conditions that put you at risk for clotting** include heart disease, diabetes, and obesity. It may lead to serious complications, such as:

Stroke- A blood clot can block blood vessels in your brain, interrupting blood flow and leading to a stroke. If a clot temporarily reduces blood flow, you can have a transient ischemic attack (TIA), or ministroke.

Pulmonary embolism- A pulmonary embolism is when a blood clot travels to your lungs and blocks the flow of blood. This can decrease oxygen levels and damage lung tissue.

Heart attack- A heart attack happens when blood flow to your heart tissue is cut off. Blood clots are a potential cause of heart attacks.

It's also possible that a blood clot could restrict blood flow in other parts of your body, causing potentially serious damage. Some examples of other areas that a blood clot may affect include: limbs, gastrointestinal tract, kidneys etc.

Blood clots are often treated with a medication called a blood thinner, which reduces clotting in your body. Blood thinners can help prevent existing clots from getting bigger and keep new clots from forming.



CRP test

CRP is a type of protein produced by the liver that serves as an early marker of infection and inflammation. In blood, the normal concentration of CRP is less than 10 mg/L; however, it rises rapidly within 6 to 8 hours and gives the highest peak in 48 hours from the disease onset. Its half-life is about 19 hours and its concentration decreases when the inflammatory stages end and the patient starts healing. CRP preferably binds to phosphocholine expressed highly on the surface of damaged cells. This binding makes active the classical complement pathway of the immune system and modulates the phagocytic activity to clear microbes and damaged cells from the organism. When the inflammation or tissue damage is resolved, CRP concentration falls, making it a useful marker in monitoring disease. The elevated levels of CRP might be linked to the overproduction of inflammatory cytokines in severe patients with COVID 19. Cytokines fight against the microbes but when the immune system becomes hyperactive, it can damage lung tissue. Thus, CRP production is induced by inflammatory cytokines and by tissue destruction in patients with COVID 19. In conclusion, elevated level of CRP may be a valuable early marker in predicting the possibility of disease progression in non-severe patients with COVID 19, which can help to identify those patients an early stage for early treatment. Besides, COVID 19 patients with elevated levels of CRP need close monitoring and treatment even though they did not develop symptoms to meet the criteria for the severe disease course.¹²

D- dimer test

Blood clotting is a crucial process that prevents excessive blood loss in case of an injury. Body physiologically dissolves the clot once your injury has healed. D-dimer, a fibrin degradation product is a small protein fragment present in the blood after a blood clot is degraded by fibrinolysis. However, in case of a blood clotting disorder, clots can form even when you do not have an injury, or they do not dissolve after healing of an injury. These conditions can be very serious and life-threatening and a D-dimer test can assess if you are suffering from one of these conditions. The D-dimer test has become highly important in COVID 19 pandemic as its elevated levels have been associated with disease severity and mortality trends.^{13,14}

Glucose and Cholesterol test

Since the virus is susceptible to causing inflammation and clotting, some people report fluctuations and flare-up in their vital parameters, including blood glucose and blood pressure levels. This is also one of the reasons why COVID 19 positive patients are asked to keep a track of their vitals in recovery. That being said, post-recovery, getting routine function tests such as these could be also crucial if you have pre-existing conditions such as Type-1, Type-2 diabetes, cholesterol or are prone to cardiac complications. For

example, for many COVID patients, blood glucose levels could remain altered (go higher and lower than usual) post-recovery and a revision of medications, doctor's advice may be needed. Go for frequent checkups, and keep tracking vitals now more than ever.

Biochemistry, creatinine, liver and kidney function tests may also be recommended for the ones at risk.^{15, 16}

Neuro-function test

Many patients report neurological and psychological symptoms weeks and months after recovery, which can impact daily functioning. The emergence of these symptoms has now become a matter of concern, with more and more medical experts stressing the importance of brain and neurological function tests weeks after recovery.

Lingering symptoms of COVID, such as brain fog, anxiety, tremors, dizziness, fatigue should also be looked into. Women over the age of 40 are more prone to the risks and may need priority testing as well.¹⁷

Vitamin D test

Vitamin D is an important nutrient that supports immune function. Studies have also shown that Vitamin D supplementation could be crucial during recovery and may even help speed up recovery. Therefore, taking an essential test like the Vitamin-D test would give you a fair idea and help deal with any deficiency, if needed.

Chest scans

CT scans are suggested for their accuracy in detecting disease severity. It also showcases the level of lung involvement caused by COVID-19. While doctors say that most people's lungs recover well after COVID 19. But in some with high levels viral infection could leave many dependent on external oxygenation and respiratory support. To determine the recovery, undergoing repeat CT scans and lung function tests could be helpful and advised to some.



Figure 1: Chest scan of COVID 19 patient

Heart imaging and cardiac screenings

A COVID 19 infection triggers widespread inflammation in the body which causes weakening and damage of important heart muscles, arrhythmias and lead to complications such as myocarditis, which is one of the most common post-COVID recovery problems reported in people. For the ones already prone to heart complication risk, it can also aggravate issues. Thus, getting proper imaging scans and heart function tests should be a priority for people, especially if they suffered from a moderate or severe infection.¹⁸

CONCLUSION

Special precautions should be taken after post COVID 19 recovery. This review mainly emphasized the importance of laboratory information in the management of COVID 19. Researchers say that there are several markers in your blood and immune system which can tell to what extent the body is affected by the virus. If anyone has recently recovered from COVID 19 the tests and scans can be crucial if a person has gone through a severe infection. With more evidence suggesting that the virus could impact vital organs in a profound manner, post- scans and tests can reveal how healthy and how well the person has recovered after COVID19.

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