

# Long COVID Syndrome: Clinical manifestation And Long Term Management

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### Abstract

In 21<sup>st</sup> century the pandemic of covid-19 is the biggest crisis. Worldwide, there are vast number of confirmed cases and more than 3 million death. Virus of covid-19 spread very fast, and both long and short term symptoms have been observed. Recovery time based on patient illness, mild to severe. Study observed, that patient with long covid symptoms got physical along with mental illness. Data prevalence of covid-19 were observed symptoms like fatigue, feeling uncomfortable in breathing and myalgia, change in smell and taste, other severe symptoms were like memory loss, sleep disturbance, brain fog, etc. The main focus of this review is to manifest covid-19 long symptoms like compromised life style, diminished mental health, and unemployment. Patient need attention and support to address the impact on their mental health, unemployment, and overall quality of life for future healthcare.[1-2]

**Keywords:** Acute and post covid-19, chronic fatigue, anosmia, dyspnea, brain fog, NIH, RECOVER.

### Introduction

Worldwide, there vast number of cases has been observed with mild to moderate covid-19 symptoms. World health organization (WHO) has formally established the term “long covid” (post covid) to describe the continuation or development of symptoms associated with the corona virus. This condition typically manifests or persists three months from the onset of the initial acute covid-19 infection [3].

This review article provide a comprehensive overview of the current understanding of long covid, highlighting potential management strategies and thereapeutics. Patients suffering from covid-19 which is caused by severe acute respiratory syndrome corona virus-2 (SARS-CoV-2) that is single stranded RNA corona virus. Subsequent to the intial infection, patients present with symptoms spanning the acute and post- acute phases of illness. The entry receptors for corona virus are Angiotensin-converting Enzyme 2(ACE2) and utilize transmembrane protease serine 2 to enter into host cell to seize the cell for replication of RNA. Once the RNA relicates extensively into numerous copies within the host cell, the acute phase of infection begins to manifest.

The initial symptoms typically presents as fever and cough. In moderate-to-severe cases, this followed by the onset of acute respiratory distress syndrome (ARDS) or rapid progression into severe pneumonia and dyspnea. Furthermore, severe pneumonia and ARDS can lead to pathological deterioration, including septic shock and

multi-system organ failure, which account for the high morbidity and mortality observed among severely infected patients. These article contain summaries covid-19 symptoms like primary after infection and long covid symptoms along with complications and management of covid-19 long symptoms.[4,5]

### **Insight from studies on long covid**

Based on many studies, we now know that covid-19 symptoms vary a lot and can affect different organs in different ways. Even after recovery and complete treatment, different organ can experience their own long-term symptoms.

### **How covid-19 affects the body and causes long covid**

#### **How the virus enters the body**

Covid-19 mostly attacks the breathing system(lungs and airways). The virus uses its “spike protein” to attach itself to a specific receptor on human cells called ACE-2. Once attached, the virus enters the cell, uses cell’s own machinery to copy itself, and then spreads to infect neighboring cells. Since ACE-2 receptors are found in many parts of the body-like the lungs, nose, intestine, and liver- the virus can target all these areas. [6]

#### **The body’s overreaction (immune response)**

The virus itself causes some damage, but the real trouble happens when our body’s immune system overreacts. This extreme reaction is called “cytokine storm”. Immune cells (like T cells and macrophages) become hyperactive and release harmful chemicals that end up damaging the body’s own tissues and healthy organs.

#### **Blood clots and serious risk**

This intense inflammation upsets the body’s normal blood clotting system. It greatly increase the risk of dangerous blood clots, which can lead to life threatening conditions like stroke, heart attack, lung blockages(pulmonary embolism), or even sudden death.[6-9]

### **Why long covid happens**

An unbalanced or confused immune system is big reason why people face long term health problems after recovering from covid-19. Scientist believe long covid might be caused by:

- The immune system attacking the body by mistake (automatically).
- Damage to the inner lining of blood vessels.
- Hidden pieces of the virus staying active inside the body for a long time.

Because data on long covid comes from different types of patients and timelines, doctors still don’t have one clear answer for its cause. This makes it a challenge to fine a single, perfect treatment.

## Long Term Complications of Covid-19

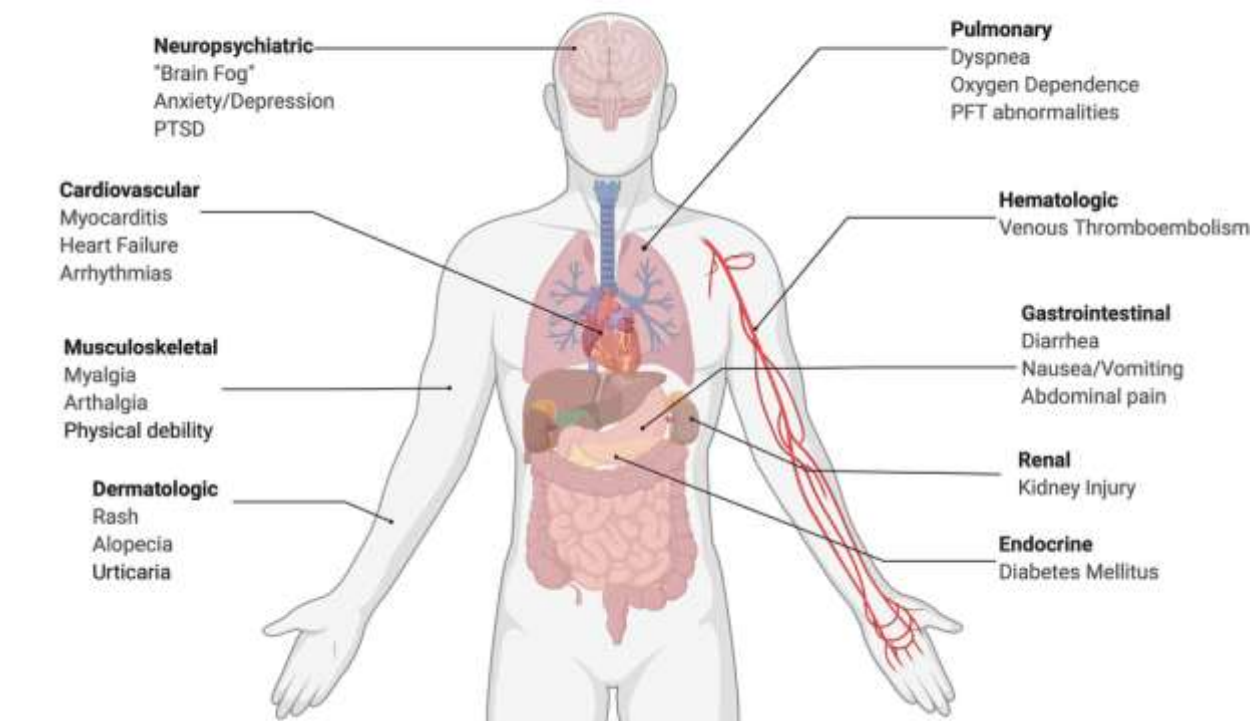


Figure 1. Schematic representation of long-term sequelae observed following COVID-19 infection.

### Clinical classification of post-acute covid-19 organ damage and sequelae

#### 1. Pulmonary sequelae (lung damage)

The respiratory system is frequently the primary site of acute injury, often transitioning into long-term functional impairment. Residual pulmonary complications include:

- **Dyspnea:** Chronic shortness of breath or persistent breathing difficulties during routine activities.
- **Oxygen dependence:** A continuous clinical requirement for supplemental oxygen therapy long after viral clearance.
- **Pulmonary function test (PFT) abnormalities:** documented drops in lung capacity, gas exchange efficiency, or restrictive lung patterns.[13]

#### 2. Cardiovascular sequelae (heart damage)

Viral infiltration and systemic inflammation can leave lasting structural and electrical damage on the heart tissue. The primary cardiac complications are:

- **Myocarditis:** Persistent inflammation of the heart muscle tissue, which can weaken the organ.
- **Heart failure:** A chronic condition where the heart muscles is unable to pump blood efficiently enough to meet the body's metabolic needs.
- **Arrhythmias:** Disruption in the heart's electrical conduction system, leading to irregular or rapid heartbeats.

### 3. Neuropsychiatric sequelae (brain & psychological impact)

Neurological involvement and psychological trauma constitute a major subset of long term disability. These manifestation present as:

- Brain fog: A broad term for cognitive dysfunction, including memory deficits, poor concentration, and mental fatigue.
- Anxiety and depression: New onset or severely exacerbated clinical mood disorders.[10]
- Post- traumatic stress disorder: Psychological distress stemming from illness, fear of mortality, or prolonged hospitalization.

### 4. Hematologic sequelae (blood & vascular system)

Covid-19 triggers a hypercoagulable (increased clotting) state that can persist into the recovery phase, manifesting primarily as:

- Venous thromboembolism(VTE): The formation of dangerous blood clots within the deep veins, posing risk of migration to the lungs or brain.

### 5. Gastrointestinal sequelae (digestive system)

The gastrointestinal tract possesses high viral receptor density, frequently leading to prolonged metabolic and digestive disturbance:

- Diarrhea: Chronic or recurring loose stools due to altered gut microbiota or mucosal irritation.
- Nausea and vomiting: Ongoing upper gastrointestinal distress and food intolerance.
- Abdominal pain: Persistent localized or generalized cramping and discomfort within the abdominal cavity.

### 6. Renal sequelae (kidney damage)

- Kidney injury: Acute kidney damage sustained during severe infection can fail to resolve completely, leaving patients with residual or chronic renal insufficiency.

### 7. Endocrine sequelae (hormonal & metabolic impact)

- Diabetes mellitus: The virus can disrupt metabolic homeostasis, leading to the clinical onset of new type or unmasked diabetes post infection.

### 8. Musculoskeletal sequelae ( muscle, joint, & functional weakness)

Systemic inflammation and extended bed rest contribute heavily to long term physical deconditioning:

- Myalgia: Persistent, diffuse muscle aches and soreness.
- Arthralgia: Chronic joint pain and stiffness absent of primary structural arthritis.
- Physical debility: Generalized operational weakness, profound fatigue, and a reduced capacity for physical exertion.

### 9. Dermatologic sequelae (skin &hair integrity)

Cutaneous symptoms can continue to erupt or persist well into the convalescent period, including:

- Rash: Various forms of inflammation or vascular skin lesions.
- Alopecia: Telogen effluvium, characterized by widespread, rapid hair shedding or thinning.
- Urticaria: Chronic hives or vascular welts accompanied by severe itching.[10-13]

## **Primary care management strategy for long covid**

### **1. Primary healthcare provider(PCP) as the anchor**

The family doctor or primary care physician acts as the central coordinator of care.

- Comprehensive assessment: Initial baseline checkups to rule out other medical conditions and systemically map out the patient's unique symptoms.
- Symptom-targeted therapy: Using accessible, standard medication to manage individual issues (e.g., simple medication for acid reflux, basic beta-blockers for high heart rates, gentle pain relievers for joint pain).
- Regular monitoring: Scheduling routine follow-ups to track recovery progress and adjusting the treatment plan as symptoms shift over time.

### **2. Personalized patient guidance & validation**

Because long covid can be frustrating and unpredictable, giving patient clear, logical strategies to manage their energy is essential.

- The '3 Ps' strategy(pacing, planning, prioritizing): Teaching patients how to conserve energy. This means breaking daily tasks into smaller steps and resting before exhaustion sets in to prevent symptoms flare-ups.
- Validation & reassurance: Confirming that their symptoms are real and documented, which significantly reduces health-related anxiety and help patients logically understand their recovery timeline.

### **3. Accessible rehabilitation & physical recovery**

Aggressive workouts can worsen long covid, so physical recovery must be gentle and gradual.

- Energy-paced rehabilitation: Guided, low-intensity physical activity (like stretching, light walking, or yoga) that stays strictly within the patient's current energy limits.
- Breathing retraining: Simple diaphragmatic breathing exercise practiced at home to help manage shortness of breath and stabilize the nervous system.

### **4. Psychological & counseling support**

Mental and emotional well-being are directly linked to physical healing.

- Supportive counseling: Providing a safe space for patients to process the emotional strain of dealing with a chronic, lingering illness.
- Cognitive behavioral therapy: Using structured counseling to help patient develop healthy coping mechanism, manage chronic pain, and improve sleep hygiene.

- Peer support network: Connecting individuals to local or virtual long covid support groups, ensuring they do not feel isolated during their recovery journey.

## **Future perspectives: long covid syndrome**

- Definitive biomarkers: Shifting from symptom- based diagnosis to specific blood tests, immune profiles, and autoantibody markers for accurate detection.
- Precision medicine: Moving away from a “one-size-fits-all” approach to design personalized treatments based on an individual’s specific symptoms and lab results.
- Targeted therapies: Transitioning from treating symptoms to attacking root causes, such as using long-course anti viral for viral persistence and therapies to clear microclots.
- AI & advanced diagnostics: Utilizing AI data-mapping to identify long covid subtype and advanced neuroimagine to pinpoint the exact causes of brain fog.
- Integrated care models: Expanding permanent, multidisciplinary clinics and digital health tools to manage the multisystem nature of the disease efficiently.

## **Conclusion**

### **Current clinical reality and symptoms-targeted management**

Long covid syndrome remains a highly complex, infection-associated chronic condition that presents a substantial global public health and economic challenge. Because it manifest as a multisystem disorder affecting the cardiovascular, neurological, and pulmonary system, it defies a standard, singular medical approach. Clinical evidence underscores that there is currently no definitive diagnostic test or universal cure, making personalized and symptom-targeted care the absolute cornerstone of effective management.

Recent large-scale clinical trial have reshaped the therapeutic landscape. Targeted treatment studies(such as the NIH RECOVER initiative evaluating extended antiviral courses and certain metabolic therapies) have shown null results for patients with established, long-standing disease. This indicates that managing long covid must rely heavily on addressing distinct clinical phenotypes. For instance, pacing remains the consensus first-line approach to prevent symptoms crashes in patients experiencing post-exertional malaise(PEM), whereas carefully titrated physical rehabilitation benefits those without it. Concurrently, managing secondary condition like POTS (postural orthostatic tachycardia syndrome), sleep disturbance, and cognitive deficit requires localized, multi-drug symptom control.

### **The preventive pivot and future directions**

Ultimately, the resolution of the long covid crisis lies in a dual strategy: maximizing early acute prevention-where updated vaccinations and early antiviral interventions show strong evidence in reducing overall incidence- and establishing permanent, multidisciplinary post-covid clinics. Moving forward, transitioning from

empirical symptoms management to mechanistic-driven precision medicine will be vital to restoring the quality of life for millions of affected individuals worldwide.

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