

Impact of Post-Covid Multisystem Complexity and India's Economy.

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ABSTRACT:

The globe was devastated and forever altered by the COVID-19 pandemic shock. After recovering from the COVID-19 catastrophe, COVID-19 survivors have been having problems over the previous two years. It has been claimed that the second wave of the pandemic in India has a gradually deepening (SARS-COV-2) virus infection. The pandemic's major negative effects on human health and Indian economics, particularly on household income. The article's analysis focuses on the multisystem complications that those who have recovered from the coronavirus and the state of the world economy. Coronavirus cases continue to increase, but there is still hope for a vaccine.

Key words: Post covid 19, outbreak, Multisystem complication, economic,

gone away which persist nearly more than the 12-14 weeks. some of patients experience that slow recurring or in ongoing symptoms or in acute phase or in post covid phases which may be refer in different names are the 'long COVID' 'long haul COVID' 'chronic COVID' 'post COVID syndrome' and 'post-acute COVID syndrome'. This is the study of review with the current knowledge of post COVID-19 by the term of 'Post COVID-19 Syndrome'. During pandemic so much of social interaction which led to the depression and mental stress. Because of this increasing the fear to going out for work and fear to use public transport these are the main reason for increasing the level of stress and depression. In this pandemic situation Students where they are worried about their careers; business people were they worried about losing of business. The Indian economic activity has been devastated working employers. Apart from this the households in the Indian economic system have been disrupted in post covid. Through this issue of vulnerability to households is captured through three constructs: Wage loss, Earning loss and extremely vulnerable workforce. Same as economic sector devastated like this education sector also devastated this may affect the millions of student's careers. Still, they may have hope on vaccine for recovery and back to the normal condition.

I. INTRODUCTION:

There was a devastated outbreak in world of novel corona virus in December 2019 in Wuhan and slowly spread over other countries. International committee, taxonomy of viruses, has suggested SARS-COV-2 as the name of the virus. It causes large number of death case, especially in first identification of Wuhan, China. Many scientists and researchers have focused that it is not just attacking the lungs but also causing harmful to many-body systems like immune system, hematological system, cardiovascular system, gastrointestinal system, pulmonary system, nervous system. In the early pandemic of covid 19 in world of many people believed that COVID-19 was a short-term illness. Data are available at the time of pandemic period regarding virus severity; World Health Organization (WHO) reported that mild cases are recovered approximately 2 weeks. However, in some patients have disable symptoms persist for weeks or even months. In some of these cases in few of the patients, symptoms have never

Definition of the post-covid-19 syndrome:

The post-COVID-19 syndrome was an unexplained signs or symptoms over 12-14 weeks, developed after the COVID-19 infection. Prolonged COVID-19 is commonly used to describe signs and symptoms that continue or develop after acute COVID-19. It includes continuous symptomatic COVID-19, called ongoing symptomatic COVID-19 (4 to 12 weeks), and post-COVID-19 syndrome (Figure 1).

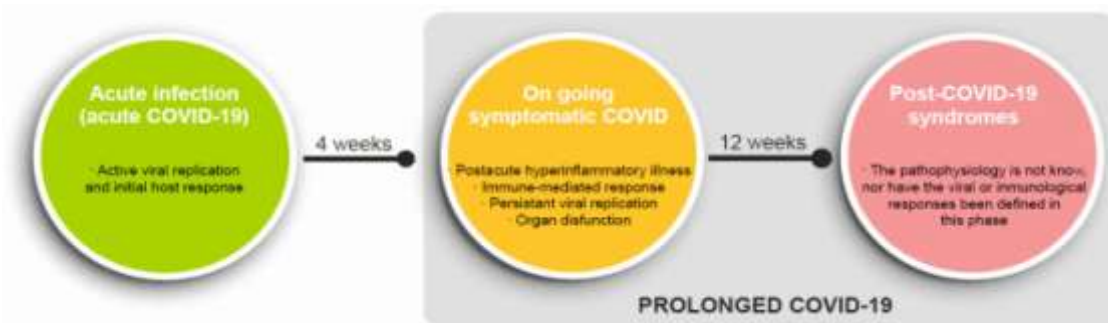


Fig 1. Evolutionary phases of SARS- CoV-2 infection to post-COVID19 syndrome

MULTISYSTEM COMPLICATION IN POST –COVID 19:

The research of post-COVID (i.e., short-term) and long-COVID (i.e., long-term) impacts, in particular in local and systemic pathways of physiological consequences in other Coronavirus-related disorders that are crucial, such as Middle

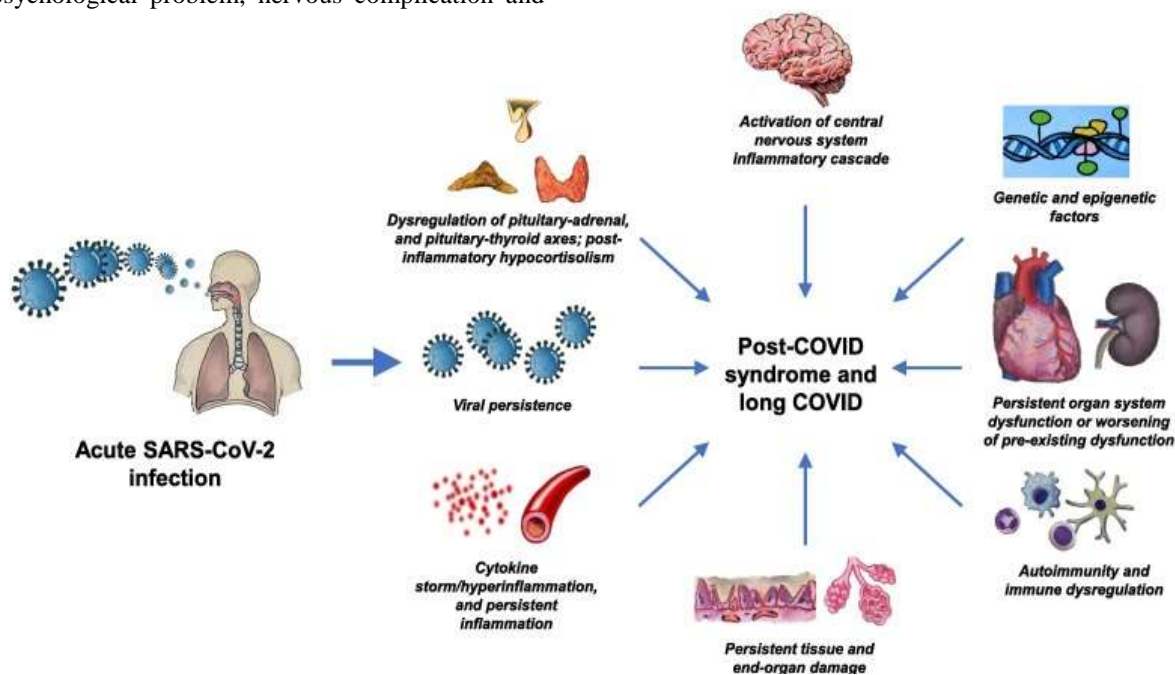
East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS), is well documented. Such negative impacts, according to the researchers, were not localized. Instead, they had an impact on numerous human systems, such as.

S.NO	SYSTEM	DISORDERS
1	Mental health	Stress, depression and anxiety
2	Nervous system	loss of taste/smell/hearing, headaches, spasms, convulsions, confusion, visual impairment, nerve pain, dizziness, impaired consciousness, nausea/vomiting, hemiplegic, ataxia, stroke, cerebral hemorrhage
3	Cardiovascular System	myocardial hypertrophy, coronary artery atherosclerosis, focal myocardial fibrosis, acute myocardial infarction, cardiac hypertrophy
4	Gastrointestinal, hepatic, renal system	diarrhea, nausea/vomiting, abdominal pain, anorexia, acid reflux, gastrointestinal hemorrhage, lack of appetite/constipation
5	Skeletomuscular system	immune-mediated skin diseases, psoriasis, lupus

6	Hematological system	vascular homeostasis, blood coagulation
7	Pulmonary system	respiratory failure, pulmonary thromboembolism, pulmonary embolism, pneumonia, pulmonary vascular damage, pulmonary fibrosis
8	Immune system	Guillain–Barre syndrome, rheumatoid arthritis, pediatric inflammatory multisystem syndromes such as Kawasaki disease

Above disorders are being affected by infected person in pre and post COVID, suffer from psychological problem, nervous complication and

pulmonary impact are major complication are faced by the recovered patients.



Potential path physiological mechanisms involved in the development of post- COVID syndrome and long COVID

COMPLICATIONS AND IMPACTS ON MENTAL HEALTH:

The COVID-19 pandemic caused mental health issues in the global population, which also involve physical pathologies. The two primary measures taken to stop the disease's spread were quarantine and self-isolation, which may have resulted in profound alterations in people's lifestyles⁹ and brought to panic and distress in a

substantial number of people. Depression, anxiety, and stress are the three most common effects of the COVID-19 epidemic on mental health. Over 50% of those who participated in the interviews displayed signs of stress, sadness, and anxiety and over 30% of them had family members or friends who had been given the COVID-19 diagnosis. In the same survey, 39% of participants were let go from their jobs, and more than 37% followed

pandemic news for more than two hours each day. Compared to other occupational groups, COVID-19-affected health workers have been more significantly impacted by psychiatric problems linked to stress, sadness, anxiety, sleeplessness, and indirect trauma.

Post covid-19 psychosocial effects:

COVID-19 survivors may experience psychosocial illnesses as anxiety, post-traumatic stress disorder, and depression. Others worry about stigmatization because they have spent a lot of time alone and are constantly worried about surviving. Depression, worry, and stress can also have a psychologically negative impact on family members of COVID-19 survivors. Social workers or rehabilitation psychologists for individuals with depression, anxiety, or PTSD should perform psychosocial rehabilitation. Education about the value of taking part in social and family activities should also be provided.

Disease management:

Patients who return home from isolation and need to shake off the experience of confinement are vulnerable to a range of mental health problems because case visits are used to manage cases at the highest level of hospitalization, such as those who require professional care equipment or specific cases requiring a high level of management. Through various virtual platforms, a daily follow-up is available and can stop suicide instances.

COMPLICATIONS OF NERVOUS SYSTEM:

SARs-COV-2 may have long-lasting neurotoxin effects on the brain. There have been examples of sub-acute indications that appeared 3–10 days after the onset of COVID-19 symptoms, Guillain–Barre syndrome, and Miller–Fisher syndrome. COVID-19 survivors have the danger of acquiring long-term neurological effects, either by exacerbating an already-existing neurological condition or by causing a new disorder, as are examples of Kawasaki-like multisystem inflammatory syndromes, which are already being discovered in children. According to the study, some patients exhibit anosmia, cognitive impairment, brain fog, anxiety, suicidal thoughts, and even conduct. All of these symptoms are present before or after respiratory symptoms and are unrelated to respiratory insufficiency, suggesting brain damage-related individualistic behavior.

Complication of nervous system are in two bases are CNS and PNS

Central Nervous System (CNS) Manifestations of Covid-19:

The MERS-CoV and SARS-CoV-1 coronavirus strains that cause neurological damage are in the same class as COVID-19's propensity for neuroinvasiveness. Since ACE-2 is a powerful target for COVID-19 and has been recognized as a functional receptor for COVID-19, it can be found in numerous human organs, including the neurological system, respiratory system, and vascular endothelium. The olfactory sensory nerve, vascular endothelium at the blood-brain barrier, the increased amount of Angiotensin-converting enzyme (ACE-2) receptors present in vascular endothelium, and leucocyte migration across the blood-brain barrier are all direct invasion mechanisms associated with the central nervous system (CNS). The frontal lobe, restricted diffusion on MRI, and enlargement in the top part of the nasal cavity known as the olfactory cleft are all symptoms related with reports of a higher prevalence of both loss of smell and taste. As hyposmia is a typical symptom of respiratory disease, the olfactory nerve may play a role in its development.

Peripheral Nervous System (PNS) manifestations of covid-19:

The most well-known PNS diseases include Guillain-Barre syndrome (GBS), neuropathies, brachial plexopathy, and myopathies. Numerous COVID-19 CNS and PNS-related neurological issues are known to be caused by infection of the post- and Para-processes.

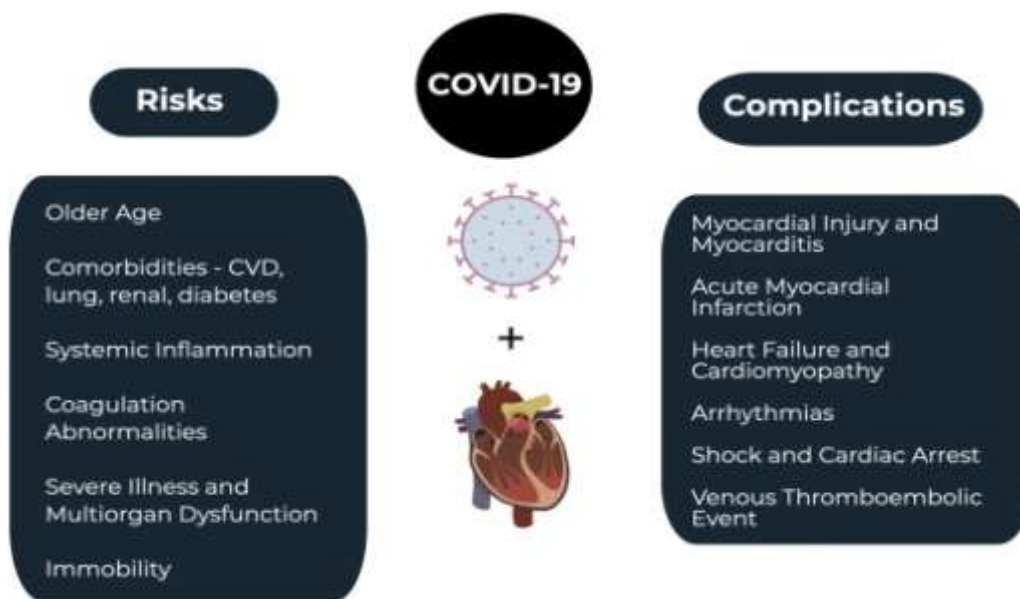
Cytokine storm was brought on by the immune system being amplified and stimulated to fight this illness. An immune system cell known as a neutrophil or natural killer cell secretes cytokines including IL-1 and TNF alpha, which can trigger inflammatory cytokine cascades and cause collateral damage. Additionally, post-infection inflammation of the brain and spinal cord with cross-reactions against myelin auto antigens is found to be hypothesized by molecular mimicry. Most patients with this illness express hypogeusia and hyposmia, which are PNS-related symptoms. This demonstrated COVID-19 examples. Olfactory symptoms could manifest earlier than any other symptoms, indicating that they are crucial for early disease detection.

The suggested indirect effects of SARS-CoV-2 on the brain are:

1. **Neuron-inflammation:** a cytokine storm, induced by the immune system in reaction to the virus, can spread through the body, pass the blood brain barrier, and can cause brain infections or damage nearby neurons and glial cells.
2. **Blood pressure imbalance:** since ACE2 regulates blood pressure in the rennin Angiotensin aldosterone system (RAS), damage of the ACE2 receptor can lead to hypertension or hypotension.
3. **Hypoxia:** metabolic disruption, caused by lung damage, can lead to an oxygen deficiency in the brain
4. **Thrombosis:** thrombotic complications can lead to ischemic stroke.

COMPLICATIONS OF THE CARDIOVASCULAR SYSTEM:

Myocardial damage, myocarditis, and heart failure are all linked by path physiological findings in SARS-CoV and MERS-CoV patients. The primary causes of myocardial damage, on the other hand, are varied and primarily involve the cardiovascular and vascular systems. In these instances, SARS-Cov-2-caused severe infection of the acute respiratory tract has a variety of negative effects on the cardiovascular system. In turn, a poor prognosis result from this. Cardiovascular comorbidities in patients may be linked to an increased risk of dying from COVID-19, according to growing amounts of clinical evidence and epidemiological results.



COVID-19 and the cardiovascular syst

Myocardial injury and Myocarditis:

A study of patients with COVID-19 was one of the first to document cardiac damage linked to SARSCoV-2. The electrocardiogram (ECG) can show a variety of abnormalities, some of which can be confused with acute coronary syndrome (ACS). The ECG abnormalities, which are caused by myocardial inflammation, include PR segment and ST segment deviations, non-specific ST segment-T wave abnormalities, and T wave inversion (depression and elevation). In the context of COVID-19, ECG irregularities are indicators of illness severity and are associated with worse outcomes. Additionally, in patients with severe

infections of COVID-19, troponin increases have been directly linked to an increased risk of negative outcomes, including fatality.

Acute myocardial infarction:

Atherosclerotic plaque disruption and AMI are more likely to occur when there is severe systemic inflammation. Patients with COVID-19 16 may have an increased risk of AMI because of widespread inflammation and hypercoagulability. The management of AMI in COVID-19 patients is debatable.

Acute heart failure and cardiomyopathy:

The most obvious sign of COVID-19 infection can be acute cardiac failure. According to a different study, heart failure affected 24% of patients and was linked to a higher risk of dying. It is still unknown if heart failure is brought on by a newly found cardiomyopathy or an aggravation of an undiagnosed heart failure. When giving intravenous fluids, it is crucial to be aware of this possible heart dysfunction.

Venous Thromboembolic event:

The prevalence of VTEs is also higher in patients with COVID-19. A number of conditions, including multiorgan failure, systemic inflammation, aberrant coagulation status, and severe illness, may raise the risk of VTE. According to studies, patients with COVID-19 exhibit serious coagulation pathway abnormalities, including increased D-dimers. According to one study, anticoagulation, mostly with low molecular weight heparin, may lower mortality in those with severe COVID-19 infections or those whose D-dimer levels are higher than the upper limit of normal.

Medication interactions:

Numerous recently investigated pharmaceuticals, such as antihypertensive, antiarrhythmic, anticoagulants, antiplatelet, and statins, interact significantly with other cardiovascular treatments. Antiviral drugs (such as remdesivir, ribavirin, lopinavir/ritonavir, and favipiravir), antimalarial drugs (such as chloroquine, hydroxychloroquine), azithromycin, corticosteroids, and biologics are now being studied (tocilizumab).

Complications Of Gastrointestinal, Hepatic, And Renal System:

In people with COVID-19, digestive system inflammation-related problems are not unusual. In epidemiological studies of people infected with the new coronavirus, symptoms such as diarrhea, nausea, vomiting, stomach discomfort, anorexia, acid reflux, gastrointestinal bleeding, loss of appetite, and constipation have been noted. These signs and symptoms may appear during the viral phase of the illness or as long-term unfavorable gastrointestinal repercussions. The malfunction of intestinal metabolites can be brought on by a number of causes, including obesity, advanced age, diabetes, a poor diet, and malnutrition. Given that COVID-19 patients' faeces

can test positive for SARS-CoV-2 nucleic acids, the possibility of disease transmission via the fecal-oral route should also be taken into account. The prothrombotic states that can be brought on by the hyper-inflammatory changes brought on by COVID-19 in the cardiopulmonary vasculature can affect blood flow to other organs. In patients with COVID-19, renal infarctions (mostly brought on by thromboembolism) are regarded as quite uncommon. The evidence points to the possibility that COVID-19 infections can result in renal failure, micro vascular blockage, and infarction, as well as macro and microthromboembolism. According to Idilman et al., many COVID-19 patients have perfusion deficits (PD) in their kidneys and lungs, which may indicate the presence of systemic microangiopathy with micro thrombosis.

Complications Of Skeletomuscular System:

The prevalence of central and peripheral neurological symptoms can be correlated with musculoskeletal problems. SARS-CoV-2-related viral infections can cause immune-mediated skin disorders. Immunosuppressive medications are used to reduce hyper-inflammatory reactions, which are marked by hyper-activated macrophages and high levels of pro-inflammatory cytokines in COVID-19. Dermal involvement is indirect, with skin symptoms occurring regardless of the disease's stage or severity. These could include dermatomyositis, an inflammatory myopathy that has been linked to SARS-CoV-2 infections that affects the skin and other organs, causing weakness and rashes. A number of clinical illnesses linked to vacuities in SARS-CoV-2 patients as well as systemic lupus erythematosus (SLE), a chronic rheumatologic disease, are other related diseases. SLE is a direct manifestation of COVID-19. These people can also exhibit hives, rashes, and acrocyanosis at any age.

COMPLICATIONS OF THE PULMONARY SYSTEM:

The cardiopulmonary system is significantly damaged by the complicated path physiology of the SARS-CoV-2 infection, which also affects other organs and systems. Hypoxia and the abnormal results of modest, non-invasive autopsies performed on patients can both serve as indicators of the lungs' progressive functional failure as target organs of the respiratory system. A growing number of clinically examined SARS-CoV-2 infections have shown that the virus affects

the pulmonary system, leading to severe respiratory failure as well as additional pulmonary clinical symptoms. One of the most aggressive symptoms of immune responses that are amplified by viral infection is respiratory system dysfunction.

Chronic cough and its management:

Along with symptoms including chronic fatigue, headache, and generalized discomfort, cough, one of the early indications of acute COVID-19 disease, is a condition that is frequently seen in post-COVID syndrome. In some people, the cause of their cough is unclear. Contrary to cough that lingers after a cold or the flu, post-COVID syndrome's chronic cough is frequently accompanied by additional multisystem manifestations that could point to a multifactorial pathophysiology or shared processes driving these symptoms. Invasion of vagal sensory neurons by SARSCoV-2, a neuroinflammatory response, or both may cause coughing, which may result in peripheral and/or central cough circuits that are hypersensitive.

Cavitary lesions and management:

When a lesion's necrotic part liquefies and is evacuated down the bronchial tree, an air-filled gap known as a cavity is created within the lesion's pulmonary consolidation, mass, or nodule. Even in

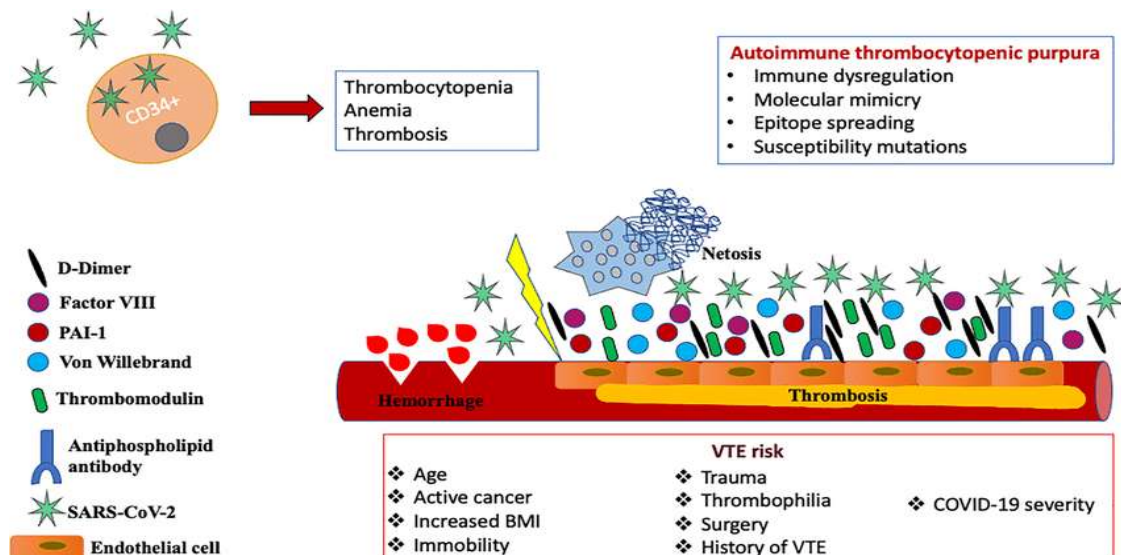
cases of severe and advanced viral infection, viral pneumonias (such as SARS-CoV and MERS-CoV) seldom result in lung cavitation.

Small airway disease and its management:

A very recent clinical situation is the emergence of small airway disease (SAD) in post-COVID syndrome. Despite the fact that it can be challenging to identify small airways on a CT scan, studies have shown that air trapping can serve as a biomarker for functional SAD. According to this study, SARS-CoV-2 infection alone causes functional SAD and air trapping, whereas lung injury and ARDS, regardless of the underlying cause, cause restrictive lung disease and impairment in gas exchange.

Complications Of The Hematological System:

The pathophysiology of a COVID-19 infection involves a number of vital organic systems needed to maintain homeostasis. Procoagulant and proinflammatory cytokines are released, activating disseminated intravascular coagulation and the development of thromboembolic states that can aggressively affect various tissues, especially those that are more susceptible to ischemic processes, such as pulmonary, cardiovascular, and curricular tissues. This directly affects blood coagulation.



Schematic overview of late-onset hematologic complications post COVID-19

Thrombotic and hemorrhagic events:

The severity of the COVID-19 infection (ICU stay, length of hospital stay), as well as the usual risk factors for thrombosis and unfavorable outcomes, are related to the probability of thrombotic problems in the post-acute context. For up to 90 days after being discharged from the hospital, patients with acute medical illnesses who are also in the acute phase of COVID-19 are at risk for VTE. Extended thromboprophylaxis lowers this risk but raises the risk of bleeding; therefore, it is not typically advised. If extended thromboprophylaxis should be utilised, it is currently debatable and being researched due to the low prevalence of thrombotic problems in the post-acute phase of the disease.

Autoimmune hematological disorders:

Although it occurs infrequently, autoimmunity thrombocytopenic purpura (ITP) has been identified as a COVID-19 late manifestation. Between 3 and 4 weeks after the development of COVID-19 symptoms in the post-acute phase, delayed-onset ITP has been documented. Only a small number of patients received thrombopoietin receptor agonist as a second-line treatment after successfully receiving intravenous immunoglobulin and glucocorticoids for the majority of patients.

COMPLICATIONS OF THE IMMUNE SYSTEM :

The pathophysiology of the COVID-19 infection involves the patient's immune system. Studies addressing the immune response during and after COVID-19 infection are still lacking. Numerous immunological impacts were observed during and during the convalescent stage, according to studies. According to studies, the virus continues to be present in the patients' faeces and sputum even after they leave the hospital. Furthermore, additional accounts claimed that the virus was found in the patients' sputum and that after a negative PCR, it was found in the patients' faeces. There has not yet been any research on Post COVID-19 Effects on various body systems. Effects of COVID-19 on various body systems a review of the literature on immunological or other scientific data that could support the feasibility of injecting COVID-19 again. Even those patients who were released after testing negative but then returned after testing positive are not believed to have been reinforced. Technical blunders while sample or transit, the detoxication process, and other factors are the causes of these positive

retests. State of the silent carrier Those individuals are also young and were initially tested using commercially accessible kits before being retested using more sensitivity testing. Therefore, we can state that the infection provides a future patient with viral protection.

POST COVID ECONOMIC IMPACT:

The COVID-19 epidemic has been devastating for everyone in the world. The world's major economies are all currently seeing unprecedented closures of business markets, malls, factories, schools, and colleges, as well as flights and tourists. The result has wreaked havoc on the stock market and global economy. According to estimates from the Organization for Economic Cooperation and Development (OECD), the rate of global economic growth may drop as low as 1.5%. India "faces a substantial fall in government revenues and growth of the income for at least two quarters as the Corona Virus damages economic activities of the country as a whole," according to an estimate by the Economic Times.

Use social safety nets as a bridge between health and economic shocks:

The lockdown effectively destroyed all economic activity. Informal workers employed in metropolitan areas lost their jobs and money. The most effective method to meet this pressing need is to establish a wide social safety net to provide people with food and money. On March 26, 2020, the Indian government unveiled a USD 22.5 billion rescue plan in response to the crisis, which included the distribution of food and money. Additionally, a few state governments revealed their support strategies. The "Pradhan Mantri Garib Kalyan Yojana" was the name of the central government's assistance initiative. People who have been severely impacted by the COVID-19 lockdown network are intended to receive safety under the Prime Minister's plan for the well-being of the impoverished. In a prompt response to the crisis, the Indian government unveiled a USD 22 billion aid package that includes food and cash transfers. Many state governments have made their support plans public.

Impact of post covid-19 on the household economy in India:

For developing nations like India, the COVID-19 outbreak and associated lockdowns created a number of economic difficulties. The evaluation of losses determines the appropriate

policy solutions to lessen the effects of shutdown. The relief measures announced for India vary from 0.1 to 11% of the gross domestic product. The majority of these government-backed programmes are based on imprecise estimations of impacts at the overall level, ignoring the implications for household livelihood. Particularly in the context of India, where the informal sector is a significant contributor to the economy, households play a crucial role in the circular flow of commodities and services in the economy. Three concepts are used to represent the issue of family vulnerability:

- (1) Wage loss,
- (2) Earning loss and
- (3) Extremely vulnerable workforce.

Any engagement must last at least 30 days throughout the year to be regarded as subsidiary. Using subsidiary involvement allows for a more comprehensive measurement of employment than counting simply principal engagement. Based on micro data, we create a methodical approach to take into consideration the effects of such risks on consumption, production, and distribution from the perspective of Indian households. We have done two novel things:

- (1) We control for formal employment relations and
- (2) We account for earning loss.

It is vital to note that while earnings come from self-employment, wages are a result of formal or informal work relationships. We also separate losses from primary engagements from those from subsidiary activities. Additionally, we estimate the likelihood of a change in the employment stream during a brief window of 7 days, capturing the scope of what we refer to as "extreme vulnerability."

II. CONCLUSIONS:

All of the symptomatology and systemic route physiological changes for COVID-19 that have been described so far have one thing in common: they all involve organic systems that are integrated with hematological and vascular dynamics. The primary human body systems that are impacted by COVID-19 symptoms long-term and afterward. As information and clinical experience in this timeframe accumulate, the multi-organ consequences of COVID-19 beyond the acute phase of infection are being appreciated more and more. The identification and characterization of key clinical, serological, imaging, and epidemiologic features of COVID-19 in the acute,

sub acute, and chronic disease phases are necessary active and future research, which will aid us in better understanding the pathophysiology and natural history of this new disease entity. To build a strong knowledge basis and guide clinical practice in this field, active and future clinical investigations, such as prospective cohorts and clinical trials, as well as regular review of incoming evidence by working groups and task forces, are essential. **"We are not living in fear , we are living in faith"** Currently, the primary responsibility of healthcare professionals caring for acute COVID-19 survivors is to identify, meticulously document, investigate, and manage any new or persistent symptoms, as well as to monitor organ-specific problems that emerged during the acute illness. Currently, the primary responsibility of healthcare professionals caring for acute COVID-19 survivors is to identify, meticulously document, investigate, and manage any new or persistent symptoms, as well as to monitor organ-specific problems that emerged during the acute illness. Additionally, it is essential that clinicians present information in ways that are easy to understand, like. In order to stop the spread of COVID-19, the Indian government imposed a 21-day nationwide lockdown and then continued to maintain a complete lockdown at hotspots. Although the entire lockdown has sent the Indian economy into recession, these safety measures taken by the Indian government may help contain the health catastrophe. For two reasons, India's economic shock could be far more severe. Prior to COVID-19, the economy first slowed, aggravating already high unemployment, low incomes, and rural.

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