Review Article

COVID 19: Impact on HIV Patient

Manish Kumar Agrawal[1*], Dr.B.Ray[2], Arjya Kuldeep Karna[1], Dr S.N.Dash[3]
[1.]B.Pharm, GCP, SBP, Odisha, [2.]Associate Prof. CPS, Puri, [3.]Principal, GCp, SBP, Odisha, India.
***Corresponding author's E-mail:** managr1999@gmail.com

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ABSTRACT

Coronavirus disease 2019 (COVID-19) spreads from person to person mainly through the respiratory route after an infected person coughs, sneezes, sings, talks or breathes. A new infection occurs when virus-containing particles exhaled by an infected person, either respiratory droplets or aerosols, get into the mouth, nose, or eyes of other people who are in close contact with the infected person. People with HIV (PWH) are particularly vulnerable during the time of COVID-19. PWH may not be contracting COVID-19 at disproportionate rates, which is hypothesized to be a function of antiretroviral treatment, PWH who are not taking ART or whose disease is not well managed may be at increased risk for contracting COVID-19 due to having a compromised immune system. The Present article focus the status of HIV Patient coexisting with covid-19 and possible Management by available Anti-Retroviral Therapy.

Keywords: Corona virus, Immunity, Lymphocyte, Retrovirus, Inflammation

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INTRODUCTION

The World Health Organisation (WHO) has declared the coronavirus disease 2019 (COVID-19) a pandemic[1]. A global coordinated effort is needed to stop the further spread of the virus. A pandemic is defined as "occurring over a wide geographic area and affecting an exceptionally high proportion of the population."[2] The last pandemic reported in the world was the H1N1 flu pandemic in 2009.

On 31 December 2019, a cluster of cases of pneumonia of unknown cause, in the city of Wuhan, Hubei province in China, was reported to the World Health Organisation. In January 2020, a previously unknown new virus was identified [3,4], subsequently named the 2019 novel coronavirus, and samples obtained from cases and analysis of the virus' genetics indicated that this was the cause of the outbreak. This novel coronavirus was named Coronavirus Disease 2019 (COVID-19) by WHO in February 2020.[5] The virus is referred to as SARS-CoV-2 and the associated disease is COVID-19.

To date, other six human coronaviruses (HCOVs) have been identified. Out of these, four are globally circulated in the human population and contribute to approximately one-third of common cold infections in humans. The other two viruses are Severe Acute Respiratory Syndrome Corona virus (SARS-CoV) and Middle East Respiratory Syndrome Coronavirus (MERS Coronavirus) causing severe respiratory diseases. Coronaviruses such as SARS and MERS, are zoonotic, and can be transmitted from animals (civet cats and dromedary camels, respectively) to humans.

Epidemiology

Epidemiological evidence shows that 2019-nCoV can be transmitted from one individual to another. In the previous outbreaks of other coronaviruses such as MERS-CoV and SARS, human-to-human transmission occurred most commonly through droplets, personal contact, and contaminated objects. The modes of transmission of 2019-nCoV are similar.[7]

Transmission of Corona Virus

Coronavirus disease 2019 (COVID-19) spreads from person to person mainly through the respiratory route after an infected person coughs, sneezes, sings, talks or breathes [8]. A new infection occurs when virus-containing particles exhaled by an infected person, either respiratory droplets or aerosols, get into the mouth, nose, or eyes of other people who are in close contact with the infected person[9,10,11]. During human-to-human transmission, an average 1000 infectious SARS-CoV-2 virions are thought to initiate a new infection.[12,13]

The closer people interact, and the longer they interact, the more likely they are to transmit COVID-19. Closer distances can involve larger droplets (which fall to the ground) and aerosols, whereas longer distances only involve aerosols. Larger droplets can also turn into aerosols (known as droplet nuclei) through evaporation. The relative importance of the larger droplets and the aerosols is not clear as of November 2020; however, the virus is not known to spread between rooms over long distances such as through air ducts.[15] Airborne

transmission is able to particularly occur indoors, in high-risk locations such as restaurants, choirs, gyms, nightclubs, offices, and religious venues, often when they are crowded or less ventilated. It also occurs in healthcare settings, often when aerosol-generating medical procedures are performed on COVID-19 patients.[14]

Symptoms of Covid 19

COVID-19 is a respiratory condition caused by a coronavirus. Some people are infected but do not notice any symptoms. Most people will have mild symptoms and get better on their own. But about 1 in 6 will have severe problems, such as trouble breathing. The odds of more serious symptoms are higher if you are older or have another health condition like diabetes or heart disease.

Common Symptoms

Researchers in China found that the most common symptoms among people who were hospitalized with COVID-19 include:

Fever	: 99%
Fatigue	:70%
A dry cough	: 59%
Loss of appetite	: 40%
Body aches	: 35%
Shortness of breath	: 31%
Mucus or phlegm	: 27%

Symptoms usually begin 2 to 14 days after you come into contact with the virus.

Other symptoms may include:

Sore throat

Headache

Chills, sometimes with shaking

Loss of smell or taste

Congestion or runny nose

Nausea or vomiting

Diarrhea

Emergency Symptoms

Call a doctor or hospital right away if you have one or more of these COVID-19 symptoms:

Trouble breathing

Constant pain or pressure in your chest

Bluish lips or face

Sudden confusion[16]

Human Immune System

The body contains the organs of the immune system, which protects against diseases.[17,18] It plays a key role to maintain health and pathogenesis. It also protects the body from harmful substances, germs, and cell changes (neoplasm).[19] The key player in the immune system is the white blood cells, which can travel throughout the body through the blood vessels. To monitor for invading microbes, the body exchanges cells and fluids between blood and lymphatic vessels and enables the lymphatic system.

The lymphatic vessels carry lymph. Each lymph node contains specialized compartments where they can encounter antigens. Through the incoming lymphatic vessels, the immune cells and foreign particles enter the lymph nodes. When they are in the bloodstream, they are transported to tissues throughout the body. They continue the cycle all over by patrolling for foreign antigens everywhere and then gradually drift back into the lymphatic system. The immune cells gather, work, and serve to confront antigens in lymph nodes and the spleen's compartments[20]

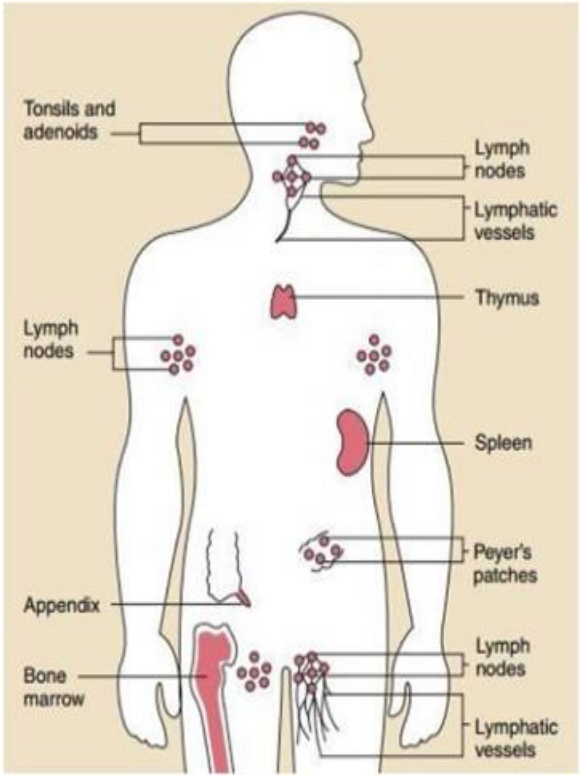

Figure 1: The organs of the immune system are positioned throughout the body[21]

Response to Covid 19 By Human Body

COVID-19 is an RNA virus with a crown-like appearance. Its diameter is approximately 60–140 nm. On one side, it has a concave surface with a ridge. It makes a larger binding interface, as well as more contacts with ACE2. It can make better contact with the N-terminal helix of ACE2 and have higher affinity[23] . It is transmitted through respiratory droplets from coughing and sneezing and enters the nasal system by inhaling and starts replicating. ACE2 is the main receptor for the COVID-19 virus .[24]

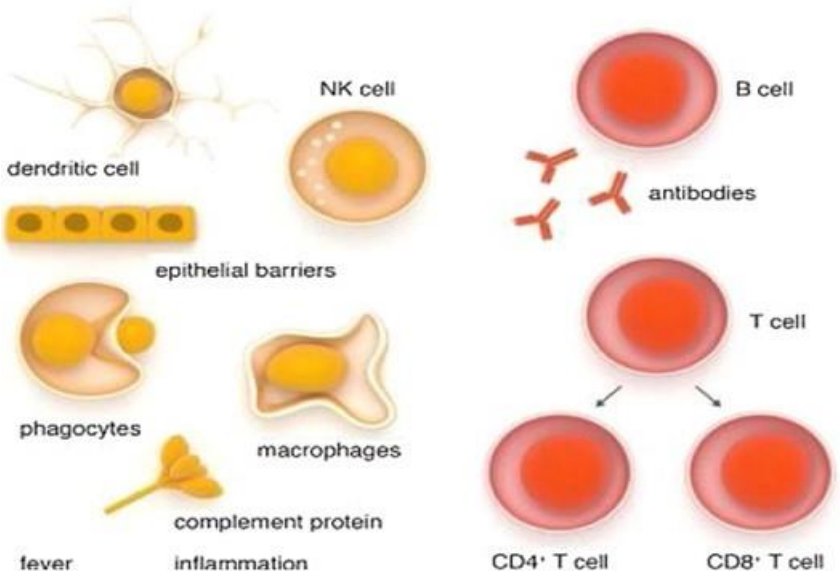

Figure 2: Innate and adaptive immune system[22]

The spike protein (S protein) present on the surface of COVID-19 is pinched inside the host cell binding to the ACE2 receptor. Here, the enzyme furin is present in the host cell and plays a vital role for the virus to enter, which was absent in SARS-CoV .[25] Next, the virus starts to propagate with limited innate immune response and can be detected by nasal swabs. The virus then propagates and reaches the respiratory tract, where it faces a more robust innate immune response. At this stage, the disease is clinically manifest and an innate response cytokine may be predictive of the subsequent clinical course[26] . For beta and lambda infections, viral-infected epithelial cells are a major source[27] . The disease will be mild for 80% of the infected patients and mostly restricted to the upper and conducting airways .[28] With conservative symptomatic therapy, these individuals may be monitored and monitored at home. Approximately 20% of the infected patients develop pulmonary infiltrates and some of these develop very severe disease .[29]

Depending on the degree of infection in the lungs, the inflammation and the fluid build-up can lead to pneumonia. A patient will require hospitalization to treat the breathlessness and ventilator support to artificially provide oxygen if the condition worsens. However, massive levels of cytokines can cause extensive lung damage and a condition called Acute Respiratory Distress Syndrome. The unsustainable cytokine storm can cause organ damage far beyond the lungs and spread to the kidneys as well as the heart. If the infection is acute, it can also lead to a depletion of the frontline white blood corpuscles tasked with fighting the infection and making the body vulnerable to other secondary infections, which may lead to death.[30]

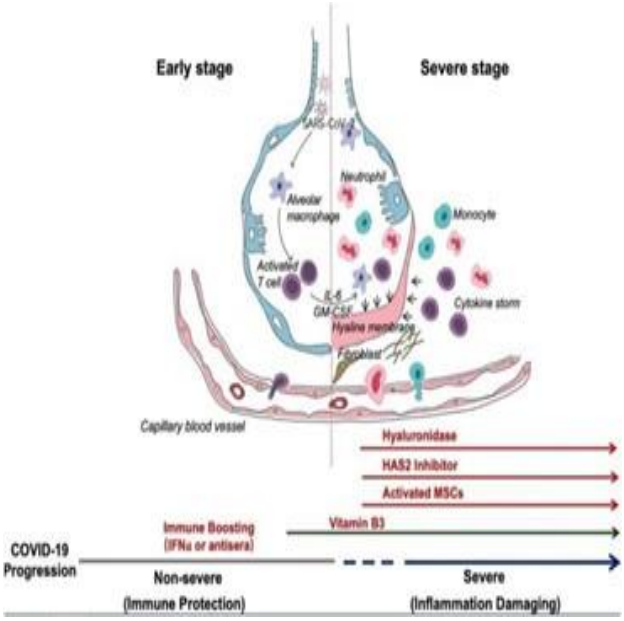

Figure 3: Progression of COVID-19 infection and potential adjuvant interventions[31].

Status of Immunity in Recovered Covid 19 Patients

According to a recent study, the immune system of Covid-19 recovered patients can fight or protect the body from the virus for at least six months, and likely much longer.

The research, published in the journal Nature, states that the immune system can even evolve to block the mutated strain of the virus, including the highly contagious South African strain. According to the scientists, including those from Rockefeller University, US, the study provides the "strongest evidence yet" that the immune system "remembers" the virus. It also continues to improve the quality of antibodies even after the infection fades away.

They further speculated that the response could be more robust in recovered patients, preventing reinfection.

Michel C. Nussenzweig, a co-author of the study from Rockefeller University said: "This is really exciting news. The type of immune response we see here could potentially provide protection for quite some time, by enabling the body to mount a rapid and effective response to the virus upon re-exposure."

Earlier studies have shown that the antibodies wane with time. However, the researchers of the new study claimed that even if the antibodies fade with time, the immune system creates memory B cells that remember the attack of the virus and can trigger proactive responses against it.[32]

Status of immunity of a HIV patient

From the time of the discovery of the acquired immune deficiency syndrome (AIDS) in 1981, it was realized that the condition involved a critical loss of immune competence that was reflected in susceptibility to opportunistic infections previously seen primarily among immune-compromised patients. Laboratory immunologic parameters that describe this severely impaired immune system include reduced T cell proliferative responses to soluble antigens and mitogens as well as impaired delayed type hypersensitivity reactions. The hallmark of this condition, recognized in the first patients, was the depletion of CD4+ T cells.[33]

The main biological event in HIV infection is the immunity system collapse, especially CD4 T cells gradual destruction that lead to a severe immune depression and consequently a high risk of opportunistic infections and cancers [34,35,36]

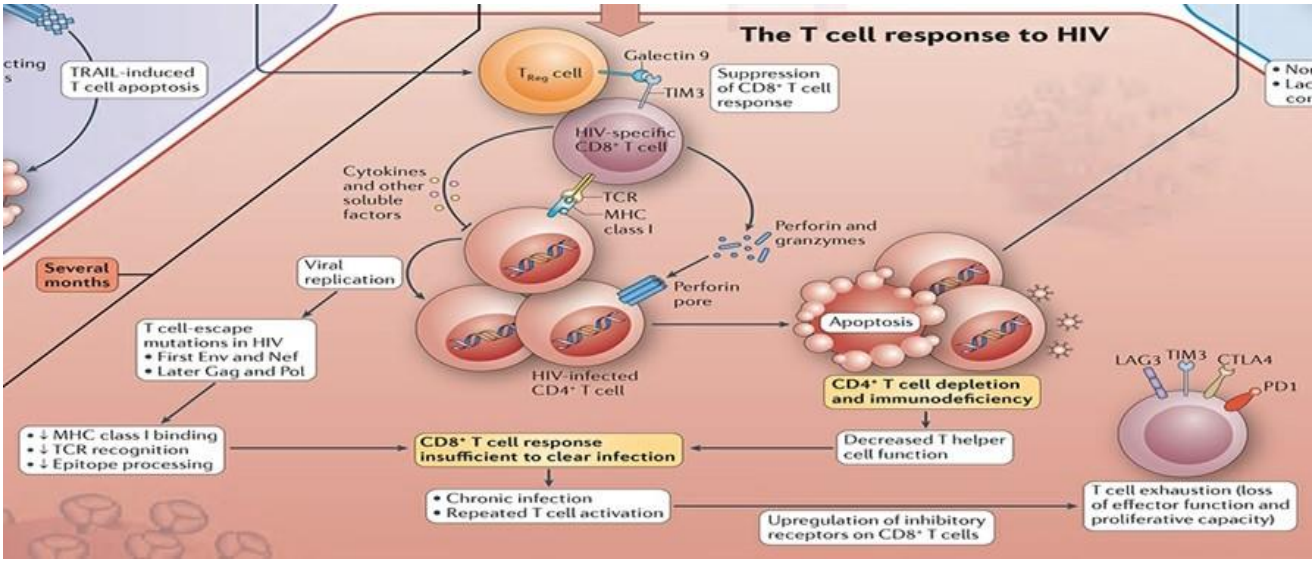

Figure 4: The T cell response to HIV

in majority of HIV-infected individuals (**c**hronic **p**rogressors, CPs), continuous production of progeny virus from the provirus causes *de novo* infections and target cell death[38,39] . The resulting progressive failure of the immune system leads to the development of **a**cquired **i**mmunodeficiency **s**yndrome (AIDS) and, ultimately, death .[40]

Impact of covid 19 on HIV patent

People with HIV (PWH) are particularly vulnerable during the time of COVID-19. PWH may not be contracting COVID-19 at disproportionate rates, which is hypothesized to be a function of antiretroviral treatment (ART;[41]), PWH who are not taking ART or whose disease is not well managed may be at increased risk for contracting COVID-19 due to having a compromised immune system and also may be at increased risk for serious symptoms and death. Beyond their increased risk for complications resulting from COVID-19, PWH are affected by the COVID-19 crisis in a myriad of other ways.

Similarities between COVID-19 and HIV

(a)Fear in the population. HIV can affect anyone, independently of their social status, race, gender, etc. This can affect people psychologically, making them feel fear, stress or anxiety. Apart from those factors, in COVID-19, there are others that can make people feel this. (b)Increased synthesis of proinflammatory cytokines. Both viruses generate an increase in the production of cytokine, and this is linked to the viral load in the case of SARS-CoV-2. These cytokines are related with secondary complications in infected people.[42] (c)HIV infection has an unfavorable effect on the interaction between the commensal microbiota and the immune system[43] Modifications of the intestinal microbiota. It has been proved that patients infected with SARS-CoV-2 who develop cardiac complications have higher levels of intestinal permeability and activation of inflammasomes, suggesting a heart-intestine axis in COVID-19[44]

Difference between COVID-19 and HIV

HIV transmission occurs through exposure to infected bodily fluids (e.g., blood, semen, vaginal fluids, breast milk). The most common transmission routes are through condomless sexual intercourse,Unlike HIV, SARS-CoV-2 is an acute respiratory infection with a short incubation period.[45,46]

Concurrent research provides some evidence that the COVID-19 or SARS-CoV-2 virus is viable on plastic and steel surfaces but less viable on cardboard or copper[47] Whereas, in HIV the virus is un-transmissible ,[48] Current estimates of the prevalence of HIV and COVID-19 coinfections come from observational studies in several countries. Vizcarra et al. noted that 51 individuals in their Madrid-based cohort of 1339 PLWH contracted COVID-19, giving a prevalence of 3.8%.[49]Richardson et al. calculated a 0.8% prevalence of HIV among 5700 patients admitted with COVID-19 in 12 New York area hospitals.[50] Multiple studies have noted that PLWH with COVID-19 have a median age about a decade lower than individuals without HIV, despite a similar prevalence of comorbidities.[50,51,52]

Several small studies have noted that COVID-19 mortality among PLWH does not differ from the general population. A case-control study in New York City that compared 88 PLWH with COVID-19 and matched them to individuals without HIV-1 infection on age, sex, race/ethnicity, and week of infection found no difference in need for mechanical ventilation or mortality.[53]

In the Western Cape study, HIV-positive individuals have a significantly higher hazard ratio of mortality than individuals without HIV after controlling for age, diabetes, hypertension, and chronic kidney disease (HR 2.75; 95% CI).[54]

The data from the ISARIC database, consisting of 53,992 individuals with COVID-19, found that hospitalized PLWH with COVID-19 had a 63% higher mortality than their HIV negative counterparts, after adjusting for age, ethnicity, comorbidities, and disease severity when they presented to the hospital.[55] Similarly, results from the Open SAFELY dataset, consisting of clinical data from hundreds of primary care practices through the UK, found a more than two-fold increase in mortality among PLWH with COVID-19 compared to those without HIV-1 infection (HR 2.30; 95% CI) after adjusting for age, ethnicity, and several comorbidities.[56]

Treatment of HIV patients affected by COVID-19

Currently available data, though limited, do not suggest that PLHIV are at risk for more severe COVID-19 disease than the general population[57] , Thus the PLHIV who have suspected, probable, or confirmed COVID-19, care and treatment for this disease should follow the same protocols as for the general population[58] , and should be managed in areas dedicated to COVID-19 care.

Several randomized and nonrandomized studies have evaluated anti-hepatitis C drugs including sofosbuvir and daclatasvir for treating of SARS-CoV-2 and while these preliminary results suggested benefit in terms of clinical recovery, this evidence is insufficient (small sample size, inclusion of a nonrandomized study) to be able to recommend using these antivirals for treating SARS-CoV-2.

CONCLUSION

The main biological event in HIV infection is the immunity system collapse, especially CD4 T cells gradual destruction that lead to a severe immune deficiency condition. Coexisting of Covid-19 make the immune status more complicated. Time to time new protocol should developed for treatment management of Such complicated situation.

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