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# Pathophysiology Of Corona Virus Infection and COVID-19 Pandemic

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**ABSTRACT**

**BACKGROUND**

The new entrant in the coronavirus family named novel coronavirus or SARS-COV-2 cases the COVID-19 which has proven deadly surpassing the one million deaths mark due to the said disease.

**SUMMARY**

The COVID-19 is wreaking havoc in all parts of the world and needs constant monitoring to establish some trends in order to device containment plans. The study of its epidemiology and pathophysiology is crucial as the viral strain is new and chance of mutation is high among it. Diagnosis and identifying the infected person must be followed by proper treatment in order to cure him and stop the viral spread. Clinical management and if required post treatment management of the infected person should be handled carefully as some patients with comorbidities are prone to severe symptoms.

**CONCLUSION**

More study needs to be done in order to constantly aligned the plan according to the clinical conditions. From non-pharmacological interventions to immune booster diet all the measures must be employed if it helps but only after establishing proper positive correlation between its effectiveness and treatment.

**KEYWORDS**

Epidemiology, Pathophysiology, Long COVID-19, COVID-19, Clinical manifestations, precautions.

## INTRODUCTION

Crossing one million mark in case fatality rate in just 9 months, COVID-19 pandemic(1) is proven to be medical disaster of the century. The crown shaped virus named coronavirus which is also has relation to previous out breaks of Severe Acute respiratory syndrome SARS and Middle Eastern respiratory syndrome causes COVID-19 or coronavirus disease 2019. Finding its origin in Wuhan city of the Hubei province of China, it has raging its wrath across the globe. All the habitable places on the earth are affected directly or indirectly mostly in negative way. The sudden emergence was shock not only for people but also for governmental agencies which employed then blanket measures like lockdown and physical distancing non-pharmacological interventions in order to break the chain. Major part of resources is dedicated to the containment strategy creating need of quickly defenestrating the virus from the society so as to continue other expenditure which

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arehalted. As of November 25, 2020 59,850,910 cases(2) have been reported touching the mark of sixty million cases worldwide and reporting 1,411,216 deaths all across the world. Top countries leading the case chart being United States of America, India, Brazil, France, Russia, Spain(3). The epidemiology and pathophysiology are being studied continuously to chalk out appropriate responses. Vaccine trials are in their last phases but it will take some more time to distribute them among such huge population figures. Till then improvisation in various measures are need of the hour to ensure not only lowers the case fatality rate but infection rate at first place. Various COVID-19 management strategies(4) are operated by the states and are in constant search of the panacea. Clinical manifestations of the disease have change from cough and cold to diarrhea and loss of test and smell. It is quite important monitor even a slight change in it. Precautions are always better and this has been proven in case of COVID-19 where huge populace needed medical attention at one particular times. Good habits such as sanitization, wearing masks, maintain safe minimum distance should be continue as they are tried and tested and found to be effective in earlier outbreaks of SARS and MERS. In this article we are going to discuss current epidemiology and clinical manifestations, its diagnosis and containment measures and also how the precautionary measures would prove effective over curative measures.

## EPIDEMIOLOGY

Coronavirus disease 2019 or popularly known as COVID-19 is wreaking havoc all over the world. The name that virus got from its shape that is crown shaped structure. Every country and all people are affected either in direct or indirect way. More than 190 countries are trying to contain the virus. Just when agencies observe that the peak is over then it starts to appear more vigorously, so the uncertainty attached with the virus spread and its effects is huge. No particular trajectory map about its possible course has been predicted. The effect is so unprecedented that it is the only widespread viral disease in last century. Last being Spanish flu that hit the world in 1918. The first appearance in Wuhan city of Hubei province of Peoples Republic of China will complete one year and now has spread to every habited continent. Countries and people are reeling under the pressure of COVID-19 which is of multi-spectral in nature(5). Initially lack of knowledge of human to human transmission and delayed conveyance of the disease huge spreading capacity had grappled the whole world within weeks. The flights from in and out of Wuhan the initial epicenter of the disease spread the virus through humans from one part of the world to nearly all parts of the world. The announcement of human to human transmission and late declaration of the disease as pandemic was proven late and by that time infected persons traveling from Wuhan has reached their respective countries. The number of arrivals(6) was so huge that it was impossible to track all the persons and some unintentionally got escaped from the screening and proven to be spreading host in home country. After that the disease which still was contained in the metro cities due to enforcement of non-pharmacological interventions like lockdown and physical distancing the gradual easing up of these restrictions diffused the disease to tier two and three cities and from there to villages. Harsh lockdown and complete enforcement made the viral spread slow but it gained the pace after removal of lockdown in dilemma between lives and livelihood as it was not feasible to confine people to their home for eternity. Although it bought some time to rethink and realigned the strategy to contain the virus which was new to all the stake holders whether medical professionals, governmental agencies or ordinary people. In initial days fear was on

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its peak and cases were low due(7) to that fear and not leaving the place of residence unnecessarily but in later stage the fear was down due to complacency and carelessness and the cases shot up exponentially. The higher case fatality rate and extremely fast rate of transmission is what makes COVID-19 more lethal and difficult to combat. The virus basically a RNA strain has spike protein and gets attached to the ACE2 receptor(8) of the host cell or human cell which further takes control of the host cell and degrades the function of the whole body.

In order to contain the viral spread, it is essential to identify the infected person. The test, trace and treat model followed sometimes by post-infection care is the most effective strategy so far. Various types of test according to source of sample, time period, error detection etc. are available. Of which RT-PCR(9) or reverse transcript polymerase chain reaction test is the golden standard accepted all across the world. It basically amplifies the RNA sample of the viral strain and detects if the presence of virus is there or not. It relies on nasal or oral swab taken from wither nostrils or mouth. But the catch is that in some cases false negative cases due to negligence in sample taking methodologies was reported. In some cases, the viral load was surpassed the nasal cavity and was present in thoracic region. Generally, the stick through which swab is collected goes only up to nostrils or oral cavity and not beyond that. But is by far the most efficient testing methods. Next is Rapid antigen test. It basically detects the antibody response generated by the body after exposed to coronavirus. The innate immune response(10) is kick started whenever any external infection is entered in the body. This can be detected by the blood sample testing which confirms either the person was exposed to virus and got treated on its own or it also indicates the current infection status. As it is antibody test where in some cases it may be long gone when the test was done, it is generally used to check the prevalence infection in extremely densely populated areas. It must ideally be confirmed by RT-PCR test upon which global community of the medical professionals rely upon. Recently a pharmaceutical firm launches saliva bases test which shows a person whether it has infection or not in half an hour. As the economic activity opens up it would be employed in drive way testing facilities and helps people on work to get them tested.

Transmission of the virus is another important aspect to be studied as to contain the virus. Human to human transmission has been confirmed in early days and this created panic as the earth is habituated by more than 7 billion people and keeping each one them apart is almost impossible especially in densely populated land masses. Transmission through nose, mouth while speaking in the form of tiny droplets is highly likely scenario. In another scenario, when fecal sludge was tested of the metro cities them the viral strain was also found to be present in the sample indicating fecal transmission. Although fecal oral route was not the significant way of transmission of virus so far. Infection through surfaces where previously infected person was in contact is also possible. The life of virus on various such surfaces varies from few hours to few days which is certainly raised the need of regular sanitation. Minimum distance of 2 meters or six feet is advised to ward of effectively the viral spread. Virus strain was also detected in blood but the chance of transmission was minimal through blood route. Transmission from mother to baby also known as pre-natal transmission is also not confirmed as some babies caught infection of COVID-19 but the source is not yet clear.

## CLINICAL MANIFESTATIONS

The clinical manifestations are another important part of pathophysiology of the

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COVID-19. There are two types of broad categories of the cases. People who shows symptoms such as cough cold and fever etc. are called symptomatic. Another category of people not showing any symptoms but are infected are called asymptomatic. Symptoms are of various grades including mild, moderate and severe types(11). Mild symptoms include low grade fever with cough and cold with sneezes. It also includes fatigue, sore throat, weakness etc. Pneumonia comes under moderate symptoms as the patient's condition deteriorate. All the other mild symptoms also continue with it. Severe and critical symptoms include acute respiratory distress syndrome with hypoxemia, injuries to internal organs and other complications(11). This stage arrives generally after clinical negligence or late reporting along with other illnesses or comorbidities. Underlying parallel illness or comorbidity is confirmed to be a deciding factor in confirming the severity levels of the COVID-19(12). Comorbid patients' needs critical care infrastructure attention in almost all the cases. Beside if they are treated and cured to well then also post-COVID-19 complications may arise the need of post treatment monitoring and care. The test, trace and treat model involves tracing the primary and secondary contacts of the confirmed positive patients. The more early the patient is detected the lesser is the chance of developing complications. Elderly, children and pregnant women(13) which are undergoing immunosuppressive stage should be protected as the damage caused by the infection can be prolonged and can create certain complications. The young age people particularly age group from 15 to 40 have found to be less prone to even gain symptoms as they are on their peak of the immune system response. But comorbid youths are also developing severe symptoms so trend is not sacrosanct. Although the infection rate is high in young age population because of their sheer numbers their case fatality rates is quite low as compared to 45(14) and above age group where in some regions the case fatality rate is as high as 25 to 30 percent. Overall fatality rate is quite low but considering the huge population size the translation of it into figures is huge surpassing the one million mark. Also, there are risk categories according to occupational vulnerability of the people. Frontline health professionals such as doctors, allied health workers, law enforcement agencies, policy making officials are vulnerable to the infection. They are categorized into high risk category. All the necessary protocols and guidelines laid down by the health ministries and World Health Organization (WHO) needs to be followed in letter and spirit in order to protect these vulnerable groups. As the COVID-19 already exposed the weak health care infrastructure all over the world and low doctor per unit population ratio it is important to protect the health professionals.

## EFFECTIVE MANAGEMENT

The containment or the management of the disease is the utmost thing to do in order to defenestrate the disease from the day to day life of the ordinary people especially when it is extremely adverse impact on their lives. Major chunk of the resource is devoted to the containment of the disease and the welfare programs takes back seat. Effective management(15) is not only containing the virus and reducing the case fatality rate but also do it in reasonable time in order to lessen the expenditure of the resources which would otherwise be used in other important and vital projects. As the coronavirus was new to the scientific as well as any other fraternity the initial response was in haste and one size fits all approach was dominating the containment efforts. But as the conceptual clarity and trends started emerging from the data more nuanced yet effective approach was followed which was more targeted and efficient. The lockdown was most common of approaches that were

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followed by the world. These blanket restrictions only lower the figures of infected persons for few days until it was found that after lifting curbs on movement the cases started rising exponentially and health care infrastructure completely collapsed. Several makeshift facilities was built in guise of stadiums, rail coaches being converted to treatment center exclusively reserved for COVID-19 patients(16). Which was the natural response by the governments to be ready for any eventualities. Another trend is that whenever there is a peak is passed prediction was proposed the virus has proved it wrong consistently. Several countries declared themselves as COVID-19 free countries only to be found later spurt of cases coming in. This pandemic has a lot of lessons to give us as humanity as whole. Resorting to isolationism in such passport less calamity which is not confined to any geographical region and covers entire globe a world as a whole approach was needed in order to get rid of the virus. Otherwise it will be recurring in some region if that region declares it to win the war against the pandemic. The coronavirus which causes COVID-19 mainly attacks respiratory system of the person and concerns with oxygen level in the body. Oxygen is the basic need of the body and vital in proper functioning. Lacking sufficient amount can quickly deteriorate the patients or persons' condition. This happens in COVID-19. Severely affected person's needs external oxygen supply and in critical cases needs ventilator assistance. Therefor checking oxygen levels among general masses randomly will not only facilitate the identification of infected persons but also unearth some lung illnesses which also affects the oxygen carrying capacity of the lungs such as asthma and other bronchial diseases.

## PRECAUTION

There are two types of care generally provided in any medical condition. First one is curative that is administered after the incident is happened and other one being preventive or precautionary measures which are employed to avoid the disease or incident contraction at first place. In this unprecedented pandemic of COVID-19 especially after the discovery of new phenomenon of longCOVID-19 where there is persistence of the symptoms and various abilities of persons are affected the preventive care is most ideal. Also, as the limited capacity of the health care infrastructure cannot accommodate such huge number of patients at one time preventive measures serves several goals or purposes in one go. Especially in elderlies where the havoc is much more than other group's precautionary measures are unavoidable. Various non-pharmacological interventions such as physical distancing, regular sanitization of hands, surfaces, wearing masks and personal and protective equipment's are proven to be extremely effective. In previous outbreaks of Ebola(17), SARS or severe acute respiratory syndrome, MERS or middle eastern respiratory syndrome the methods of wearing masks and PPE kits was found out to be extremely beneficial in tracing the contacts of the infected person so that they get treated in time and before they further spread the disease. The behavioral change induced by guidelines in people such as wearing masks and maintain physical distancing is good not only for now but for future also. The hygiene levels are increased and washing hands regularly is now becoming a natural habit among all sections of the society (18-21). The long-term complications attached to the COVID-19 which are not yet fully recognized but proven to be existed in wake of prolonging symptoms in COVID-19 cured patients have raised an additional alarm about preventive measures to be followed instinctively (22-25). Also, antibodies develop to tackle the coronavirus are not permanent and person can catch the infection again in exposed. Study is underway to observe the second

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time infection impact in patient's anatomy. Boosting immunity by various methods like proper and nutritious intake of food(26-28), exercise etc. can be very effective in order to be healthy in general. Coupling the medications with immunity booster diet using as a medication rather using it as only prophylaxis needs more study to establish the correlation between the two.

## CONCLUSION

Unprecedented calamity needs extra and effective plan to deal with it. COVID-19 is that unprecedented pandemic which has shaken the inside out of the humanity. From its advent in early 2020, new trends are emerging every day and researchers and scientific community are on to study and establish some trends which can further benefit in formulating the containment plan. The epidemiology and pathophysiology of the coronavirus needs more study to deeply understand and built a comprehensive analysis of the situation. Pandemic is still evolving and quizzing people about its peak as resurgence of cases in many places have seen. Number of waves suggests that it is not easily going and therefore it is necessary to understand its clinical manifestations carefully. The symptoms are changes from over the time and varying degree of measures are deployed in order to cure the patients. COVID-19 management has exposed the lacunas that are in health care services. Concerned agencies needs to fix this in order to be ready for such pandemic in future the preventive part is best suited for COVID-19 than curative part as its long-term implications and burden on the health care infrastructure is severe and huge respectively. Widespread awareness about physical distancing and wearing masks needs to be carried out so that people do not become complacent and care less over the time due to pandemic fatigue. As the winter is approaching in worst hit countries like India and already persisted problem of pollution can worsen the COVID-19 figures. A proper and comprehensive strategy is needed with consulting all the stake holders especially from domain expert to tackle the viral spread until the vaccine becomes available for distribution.

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