



Overview of COVID-19 Pandemic: Transmission, Epidemiology and Diagnosis

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

In the early part of the last month of the year 2019, suddenly many people started suffering from a new respiratory disease in the city of Wuhan in China. At that time the cause of the disease was not known. The disease was caused by a new coronavirus which was never detected in the past. WHO called it the novel coronavirus 2019. Later the virus was named as severe acute respiratory syndrome coronavirus 2. The disease is considered to have originated from the wet market located in the city of Wuhan in China. It came from the bats and infected the humans and possibly with an intermediate host like the pangolins. From the place it originated the disease spread to other places within China and to other countries outside China. WHO recognised the disease as a pandemic, as the disease spread to other parts of the world in Europe and Asia. This pandemic has affected the mankind as never before. More than 110 million people are confirmed infected with this disease. More than 2.5 million people have succumbed to this devastating disease. The pandemic has affected almost all the countries in the world. At a time when many countries were in lockdown mode, it seemed the world had come to a standstill. Individuals of both sexes belonging to all age groups can get infected, although old persons and persons with co-morbid conditions are more prone to get infected and also has more chance to develop severe form of this disease carrying

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high morbidity and mortality. In this review, the literature of the causative agent, epidemiology, mode of transmission, diagnosis and treatment and preventive strategies are reviewed, so that the reader is provided with sufficient current knowledge about this disease.

Keywords: Coronavirus; COVID-19; SARS-CoV-2; pandemic.

1. INTRODUCTION

The Coronavirus pandemic is still continuing, evolving and the end of this pandemic is yet to come. Hopefully it is at the tail end. The sudden occurrence of unusual viral pneumonia cases in large numbers were seen in Wuhan of China, in the beginning of the last month of the year 2019 [1]. The disease spread very fast to other places from there and on 30th Jan 2020, the WHO had to announce it a Public Health Emergency of International Concern. WHO labelled it a pandemic on 11th March 2020, as the disease spread to other countries in Europe and Asia [2]. Since then the number of cases is ever increasing and now it has crossed 110 million and with over 2.5 million death recorded worldwide. Most of the Countries responded to this pandemic by enforcing strict lockdown to prevent the spread and to buy time for preparation to fight the pandemic. Majority of the countries are now in the stage of reversing the lockdown. India is also reversing the lockdown and striving towards normalcy. The lock down worldwide had a grave impact on the mankind. But the pandemic also showed us its positive impact on our environment. New strain of the virus had emerged, adding to the already existing problem. At the same time, to our relief, the awaited vaccine against this disease has been developed and vaccination programme has started in many countries including India. The end of this dreaded pandemic is hopefully in our sight, like the proverbial ray of light at the end of the dark tunnel.

2. AGENT

The SARS-CoV-2 is a novel positive sense single stranded RNA virus. It is a beta-coronavirus belonging to the family of Coronaviridae. This virus essentially causes a zoonotic disease. There had been few outbreaks of coronavirus in the past. In 2003, an outbreak of SARS-CoV pneumonia occurred in Guangdong of China and after that, in the year 2012, another outbreak of coronavirus pneumonia occurred in the middle east caused by MERS-CoV. The outbreak started in Saudi Arabia. In both these outbreaks the causative

agent originated from bats and through the intermediate hosts which were Palm civet cats and Dromedary camels reached the human being. Genome sequences of different isolates of SARS-CoV-2 are very much alike and revealed almost absolute genomic similarity. SARS like coronaviruses which are found in bats are very similar to SARS-CoV-2, far more similar than to SARS-CoV and MERS-CoV. This agent most probably cause infection in humans by binding to the angiotensin-converting enzyme-2 receptor of cells of the host located in the mouth and nose of a person with the help of the spike protein located on the surface. It is also widely accepted to have come from the bats through one of the intermediate host like the pangolins, though possibility of other intermediate host is also there [1].

3. EPIDEMIOLOGY

When the year 2019 was ending, the Chinese health authorities informed the WHO about detecting a large number of viral pneumonia cases with no identified cause in Wuhan. The WHO was compelled to declare the emergence of the disease, as a Public Health Emergency of international Concern, after a large number of similar cases were confirmed in many countries. The viral agent which caused the disease outbreak was identified on 7 January 2020, from the throat of a patient by the Chinese Centre for Disease Control and Prevention and was named 2019-nCoV by World Health Organization, later on it came to be known as SARS-CoV-2. This coronavirus is similar to those which are found in bat, pangolin and also to the SARS-CoV. Current evidences suggest the bat as the most likely original reservoir of this virus and pangolin is one of the probable intermediate. From Wuhan, on 11th Jan 2020 came the report of the first case of death from the disease. Then the number of cases outside China increased manifold affecting many countries and the WHO recognised the disease as a pandemic on 11th March 2020 [1,2,3].

Then the pandemic gradually and steadily spread all over the globe to the present situation. India recorded its first case in Thrissur, Kerala, who

had returned from China on 30th Jan 2020 and India recorded the first death of COVID-19 on 10th March, 2020 from Karnataka. By mid July 2020, there were about one million confirmed cases in India, the cases were mainly distributed in the metropolitan cities like Delhi, Mumbai, Kolkata, Pune, Chennai. When writing this review, there are approximately 110 million confirmed cases in the world and approximately 2.5 million have died from this disease. In our country there are approximately 110 lakhs confirmed cases and about one and half lakhs have succumbed to this disease. Encouragingly about 107 lakhs cases have recovered. In a study conducted on 425 cases, the mean incubation period of the disease was observed as 5.2 days and another study in 181 confirmed cases also found the median incubation period of 5.1 days [4,5]. Most of the cases suffering from this disease recovers. In those who die from the disease, it usually happens on an average of 14 days from the start of the symptoms (ranging from 6 days to 41 days) and the mortality of COVID -19 disease is approximately 2.2% but differs from country to country and also depending on the severity of the disease [6].

4. TRANSMISSION

Currently available evidences indicate that COVID-19 may be transmitted from person to person through several routes. In humans, the primary mode of transmission is by direct or close contact. The respiratory droplets having the virus produced by coughing, sneezing by an infected person and reaching the nose, mouth or respiratory tract of another person leading to infection with the virus. Another possible way of transmission of the virus is through contaminated fomites. Contamination of the environment of a Covid-19 patient with the infective agent was observed in many studies and it is also a fact that this type of transmission occurs with other types of coronavirus. This type of transmission is particularly important in the health care settings where Covid-19 patients are managed. The live infective agent was found on the surfaces of objects in the environment of an infected person, hours and days afterwards. These surfaces get contaminated with the live virus from the respiratory secretions and droplets from an infected person. A person can get infected by touching these contaminated surfaces. Airborne transmission also known as droplet nuclei transmission can occur in hospitals where aerosols generating procedures, like endotracheal intubation, endoscopy of the

respiratory tract, pulmonary ventilation, cardiopulmonary resuscitation etc are performed. This way of transmission can also occur in indoor environment with poor ventilation and crowding inside the room. As performances and celebrations involving singing, shouting, speaking loudly take place in such events. There is no enough evidence of transmission through other body fluids like urine and faeces. Same is with regard to blood borne transmission. There is also not enough evidence of transmission from mother to fetus [7,8]. Study done on ferrets, demonstrated that the organism is transmitted from animals to animals by direct contact. In animals, airborne transmission was found to be less likely than transmission by direct contact [9].

5. CLINICAL FEATURES

COVID – 19 cases can be asymptomatic or symptomatic. They can also present with mild or moderate symptoms. Some cases are severely symptomatic presenting with severe pneumonia or with complications like sepsis, septic shock, adult respiratory distress syndrome. The common presenting complaints of the disease are cough, fever and difficulty in breathing. Patients can also present with other signs and symptoms like running nose, sore throat, fatigue, myalgia, diarrhoea, loss of smell and loss of taste etc. Elderly persons and persons suffering from diseases like diabetes, high blood pressure, heart problems, chronic respiratory diseases, chronic kidney disease etc. are likely to suffer from severe form of the disease. They are also associated with higher mortality [10].

6. DIAGNOSIS

RT- PCR is the confirmatory diagnostic test used globally. In our country, RT-PCR is used as a diagnostic as well as a confirmatory test for this disease. It is mandatory for RT-PCR to be positive before treatment of COVID-19 is undertaken. For RT-PCR, nasal swabs and oral swabs are taken for samples. True Nat is another diagnostic test of COVID-19 disease. The working principle of True Nat is similar to RT-PCR and it is done with a small machine which can be transported easily. The result is also available in a shorter time than RT-PCR. The drawback of True Nat is positive result need confirmation with RdRp gene assay. For True Nat only nasal swab is sufficient for sample. So True Nat is used both for screening and confirmation. Rapid antigen test is another diagnostic test, use for screening and population

survey, because of its easy to perform, very fast result and it is also cheap. RAT gives result in 5 to 30 minutes. In case RAT is positive, confirmation is done by performing RT-PCR. ELISA and Rapid antibody tests are tests use for detecting antibodies against the virus in the blood of a person. These tests are used for sero-surveillance and population surveillance. The imaging of the chest with CT is also a very sensitive and specific test for COVID-19. CT chest has been found to show COVID-19 lesion like infiltration, opacities and consolidation earlier than the molecular test become positive. It is used in COVID-19 suspect cases when RT-PCR or True Nat is negative. Laboratory investigations, like CBC, LFT, KFT are not specific for COVID-19. In severely symptomatic patients highly increased levels of enzymes like aspartate aminotransferase, alanine aminotransferase, lactate dehydrogenase, creatine phosphokinase and metabolic products like serum creatinine, D-Dimer and also an abnormally high prothrombin time was observed frequently [11,12].

7. TREATMENT

Finding the definitive treatment for this disease still eludes the medical scientists. Only supportive and symptomatic treatment is the way to manage this condition. Now that vaccine is available and vaccination has started in several countries, a turning point to this pandemic is expected and eminent. There were many large-scale multicentre trials, evaluating various treatment options and drugs, including the WHO SOLIDARITY and RECOVERY trials going on all over the world. One drug which is widely used for the treatment of this condition is dexamethasone. Dexamethasone was shown to decrease the number of deaths among severely ill patients on ventilator and oxygen therapy. In patients who are not on oxygen therapy, dexamethasone did not provide any advantage [13]. The use of dexamethasone was recommended for critically ill COVID-19 patients on ventilator or on oxygen support by the US National Institutes of Health. An antiviral drug, commonly used and also recommended by the European Medicines Agency is remdesivir. Study showed that patients who were administered remdesivir recovered in about 10 days whereas the patients receiving placebo recovered in about 15 days, it was also found to improve the mortality rate (6.7% vs 11.9% at day 15th and 11.4 vs 15.2% at day 29th) compare to placebo and it also decreased the incidence of serious adverse events [14]. The

combine administration of lopinavir–ritonavir was compared with the usual care in the RECOVERY Trial and in the result of the study there was no additional benefit of the antiviral drugs over the usual care, considering the clinical course, hospital stay and overall survival. The study did not include patients on mechanical ventilation, as the antiviral drugs combination has to be administered orally [15,16]. Hydroxychloroquine, is an antimalarial drug, which was also used with lots of expectation. HCQ was used in combination with azithromycin and both favourable and unfavourable results were reported by studies done in Europe and China. Later on, trials like RECOVERY, SOLIDARITY found convincing evidence that HCQ is not useful for the treatment of this disease and these trials stopped treating patients suffering from this disease with HCQ. HCQ was also not found to be of any use in post exposure prophylaxis also [17,18,19]. Study have proven that NSAIDs are not harmful to COVID-19 patients and these drugs can be used without fear in these patients for indications related to this disease or for other indications [20]. Antihypertensives belonging to the groups of angiotensin ACE inhibitor and ARB are also safe and not contraindicated to use in COVID-19 patients. Patients receiving these agents should neither stop taking these medicines nor change to other drugs [21]. Convalescent plasma transfusion for the treatment of patients suffering from this disease was appealing as the antibodies to fight against the virus is infused to an infected person. Studies have found that convalescent plasma infusion in a patient suffering from this disease does not cause significant harmful side effects, it also helps in improving the chance to recover and also a quicker recovery from the disease. In severely ill patients, convalescent plasma was found to increase the recovery rate, decrease the incidence of death, achieve faster recovery and also decrease the incidence of severe complications of the disease [22-25].

8. PREVENTION

Till now no definitive treatment of this disease is available. Prevention is the key strategy to fight against this disease. For the prevention of disease transmission, the WHO has recommended a comprehensive set of measures. The suspected cases should be identified quickly, they should be subjected to diagnostic testing and if they are confirmed to be infected, they should be isolated. The close contacts of the infected person are to be

identified and kept in quarantine. All the symptomatic persons should be tested for Covid-19. To prevent community transmission, people should use masks in public places where it is crowded and physical distancing is difficult. Along with wearing of the masks, people should maintain physical distancing, should practice frequent hand washing specially after having contact with respiratory secretions and should cover their nose and mouth with their inner elbow when coughing. In the hospitals and other health care settings, health care workers should adopt standard precautions. Health care providers should use clinical mask during all routine activity, maintain physical distancing whenever possible, should practice frequent hand washing, follow cough etiquette, wear personal protective equipment correctly and properly under right circumstances, proper cleaning and disinfection measures should be performed for equipment and environment, should follow safe practicing norms and all the medications are to be stored and handled in the proper way. All closed settings should be provided adequate ventilation. Health care workers treating should follow contact and droplet precautions when treating diagnosed or suspected cases of this disease. They should wash their hands frequently. It is preferable to keep the patients in single room with attached toilet. It is also preferable to provide different instruments and equipment for each patient. If this is not possible the instruments and equipment are to be cleaned and disinfected each time after and before use on a patient. Frequently touched objects and surfaces like door knobs, handles, table tops are to be cleaned two times a day. PPE should be worn and removed following correct procedure. Unnecessary transport of the patient from one place to another should not be allowed. The person transporting the patient should wear PPE and the patient should wear mask. Visitors should be restricted and should follow correct procedures if unavoidable. Health care workers performing aerosol generating procedures should wear PPE and use respirator mask like N95, FFP respirators [8].

The vaccine against this disease is available now. There are many types of vaccine. Some are mRNA vaccines like those developed by Pfizer-BioNtech and Moderna. Some are adenovirus vector vaccine like those from Oxford-Astra Zeneca and Sputnik V from Russia. In India Oxford-Astra Zeneca vaccine is also known by the name of Covishield and is manufactured by the Serum Institute of India. Bharat Biotech and

ICMR collaborated and developed an indigenous inactivated vaccine known by the name of Covaxin [26]. Studies have shown that the two most popular vaccines, the Pfizer and Oxford vaccine can provide immunity against the disease without significant serious side effects. The two vaccines has different efficacy and storage requirements, the first vaccine give very high chance compare to the second vaccine which give a moderate to high chance of protection against the disease, the first vaccine requires an extremely cold temperature of -60°C to -80°C while the second vaccine can be stored at 2°C to 8°C . Two doses of the vaccine are required to develop adequate immunity. The duration of interval between the two doses can range from four to twelve weeks. The duration of interval between the doses can also affect the efficacy of the vaccine [27-29]. Vaccination has started in many countries and in India also. In our country the vaccination started from 16th of January this year. We have vaccinated more than 1.2 crore healthcare and frontline workers in our country by the end of February 2021. Many studies are going on to know the outcome of vaccination. Now the vaccine will become the most important means to prevent from this disease. But along with vaccination, timely identification and proper treatment of cases [30-32], prevention of the spread of the disease through direct contact by way of social distancing [33-35], wearing of masks [36-38] and frequent hand washing [39-40] in places where social distancing is difficult are still equally important [41-44].

9. CONCLUSION

The world was taken by surprise by this pandemic. It has caused great misery to human life to the extent that it began to endanger the existence of human race. It destroyed the economy, trade and commerce, industries, health care system, institutions of the countries around the world. It rendered millions of people jobless, sick and starving. The health care workers and providers bore the maximum brunt of the pandemic and earned the name of "front line workers" and "Covid warriors". The pandemic was progressing from stage to stage and mankind also learned to face the problem from stage to stage, getting better equipped as time progressed and more and more evidences were established. New and useful evidences regarding the causative agent, the ways of transmission and clinical presentation, the means of diagnosis and treatment were established. With no

definitive treatment available for the disease, the endeavour to develop a vaccine against the disease started. Countries competed with each other to develop a vaccine sooner and faster. Pharmaceutical companies collaborated and competed with one another to develop a vaccine, better and faster than their counterparts. Now many effective and safe vaccines are available. With the development of various vaccines against this disease, the world is hopeful of the end to this pandemic. The vaccination has started worldwide, but we still have to maintain social distancing, wear masks at crowded public places and enclosed spaces and wear PPE depending on the individual, situation and environment, until the whole population of the world develop immunity against this disease.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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