

Trending outbreak of corona virus sars-cov-2: a review

Abstract

The outbreak of severe acute respiratory syndrome corona virus 2 (sars-cov-2; previously provisionally named 2019 novel corona virus or 2019-ncov) disease in china at the end of 2019 has caused a serious global health issue. It further underwent a world-wide spread, reported to be by human-to-human transmission. As reported by the world health organization (who) globally 1,812,734 positive cases; 113,675 deaths and 456,776 recovered cases have been recorded up to 14th April, 2020; 2.00am cest due to covid-19. A number of studies are being undertaken to study the possible role and nature of the virus and its impact on human life as a whole. The changing pattern in epidemiology, symptoms and spread or transmission of this virus has made it necessary to carry out further research. Records are suggestive that the viral outbreak has affected more than 200countries/regions globally. Hence it is necessary to know the possible complications, health risk groups, spread, risk factors for mortality, viral shedding, prevention and precautions to be undertaken on individual level to control the outbreak of this pandemic disease.

Keywords: corona virus, covid-19, health, transmission, pandemic

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Abbreviations: SARS, severe acute respiratory syndrome; CoV2, corona virus2; WHO, world health organization; MERS, middle east respiratory syndrome; CDC, center for disease control

Introduction

The capital of Hubei province in China, Wuhan city, suddenly turned out to be the main hub of an outburst of pneumonia of unknown cause in December, 2019. Soon later in January 2020, the Chinese scientists found out a novel category of virus named corona virus, also called as severe acute respiratory syndrome corona virus 2 (SARS-CoV-2; previously known as 2019-nCoV), from these pneumonia patients.¹ A new name for this epidemic disease caused by 2019-nCoV was announced by World Health Organization(WHO) on 11th February 2020, as corona virus disease-19 (COVID-19).² Among the chief micro-organisms or pathogens that majorly aim the human respiratory system are the corona virus group of viruses. There also have been previous outbreaks of corona viruses (CoVs) in past years. These include the Middle East respiratory syndrome (MERS)-CoV and the severe acute respiratory syndrome (SARS)-CoV. These outbreaks too have been earlier considered as a reason that caused immense threat to the well-being of society and public life.³ It was believed that the source and initiation of this virus is probably from a zoonotic transmission related with a huge seafood market. There was tradeoff of live animals in these markets too. Soon later it was evident that person-to-person transmission was possible with this virus too. The clinical symptoms associated with SARS-CoV-2 infection shows wide variation of manifestations, ranging from asymptomatic infection (commonly called as the silent carriers), mild upper respiratory tract illness, severe pneumonia, respiratory collapse and even death.¹

As per a study conducted by Chen, hospital-associated transmission of this infection was identified to be around 41%.² Considering rapid increase in incidence rate of SARS- CoV-2 infection, transmission by silent carriers & also transmission from human to human, lead it into next pandemic disease. They also studied the microbiological nature of the virus and suggested that it is similar to the corona virus variety circulating in horseshoe bats. Further analysis based on ORF1a/1b, S and N genes proposes that SARS-CoV-2 is possibly a novel corona virus that was autonomously acquainted from animals to humans. Certain investigatory findings suggest that, this infection may have been instigated from bats or bat droppings accompanying with polluted resources in the Wuhan seafood market region.²

A number of evidences of a speedy development of this infection were out. The world health organization (WHO) soon stated that COVID-19 occurrence is the sixth community health crisis of global worry, following H1N1 (2009), polio (2014), Ebola in west Africa (2016) & Ebola in the Democratic republic of Congo (2019) on 30th Jan, 2020.² Within a span of 4-5weeks the virus had infected over 50 countries/regions. On 11th march, 2020 WHO declared it as a pandemic disease.

Epidemiology

The epidemiological studies related to covid-19 are on daily changing patterns. The initial pattern of origin, transmission and rate of spread suggested that there is exponential growth of infection. Depending on the spread of infection initially during the month of December, few reports gave a range of reproduction number (mean basic) which was 2.24 to 3.38. Also, few reports later during the month of January indicated the infection doubling time to be 6.4 days.

However, the epidemic is progressing and newer updated data and research are required for further confirmations on these estimates.² As of now WHO globally has reported 1,812,734 positive cases; 113,675 deaths and 456,776 recovered cases up to 14th April, 2020; 2.00am CEST.

The sequence of events of infection spread is as follows-In the capital of Hubei province of China, the Wuhan city, the first cases were testified in December 2019. In the duration from 18th to 29th December, 2019 five suspected individuals with acute respiratory distress syndrome were hospitalized where one patient out of 5 died. Later 41 patients were admitted in the hospital until 2 Jan, 2020. These individuals were then tested in laboratory and were confirmed for Covid-19 infection after wards. It was observed that not more than 50% of these patients had primary debilitating conditions like cardiovascular disease, diabetes and hypertension. The infection to these patients was apparently thought to be spread from that hospital, probably in the form of nosocomial infection. Later it was also established that this is not a virus that was transmitted by one patient to others, but instead it is likely to spread from many patients acquiring the disease at numerous sites all over the hospital premises via unidentified mechanisms.

With all this, it was also observed that individuals who showed any signs and symptoms related to this infection were being tested for laboratory testing or presence of virus. Others who were silent carriers were not identified promptly as they didn't show any clinical signs. Hence, it was said that the actual number of cases were even more than the prevailing ones.

A total of 571 patients of COVID-19 were stated in 25 different regions of China until 22nd January, 2020. The first 17 demises were declared by The China National Health Commission until 22nd January, 2020 with their details. A report from China indicated a total of 1975 confirmed COVID-19 positive patients along with 56 deaths till 25th January, 2020. On 30th January, 2020, reports indicated a total of 7734 confirmed cases in China. It was also reported that 90 other patients were found in various countries throughout the globe. Some of these countries were Thailand, United Arab Emirates, Taiwan, Malaysia, Japan, Nepal, Korea, India, United States, Australia, Singapore, France etc. Few studies suggested the mortality rate associated with this infection to be 2.2%. Some studies also reported that individuals with more than 60years of age were said to be more prone to infection or were indicated as high-risk groups than younger population that showed only mild symptoms or no symptoms at all. The mortality rate associated showed by all the three infections of MERS-Cov, SARS-Cov and Covid-19 is different. As stated in one of the studies the mortality rate associated with Covid-19 was 2.2% approx. till 13 Feb, 2020. Whereas mortality rate for MERS-Cov was 34.4% and for SARS-CoV outbreak it was stated to be 9.6%.⁴ Some studies reported the mortality rate associated with covid-19 to be 3.46%.⁵

A first case of COVID-19 in the United States was found on 30Jan, 2020. This helped to define clinical progress and treatment of a COVID-19 positive patient. This comprised of the initial mild symptoms and advancement of this to further respiratory pneumonia on the ninth day of disease.⁶ Meanwhile 31,161 people in China were tested positive for Covid-19 as published by health authorities in a report, among which 630 people died till 7Feb, 2020.³

The incubation period of virus was suggested by few studies to be 6.4days.⁷ A common issue encountered during both the previous epidemic outbreaks (SARS-CoV and MERS-CoV) was of nosocomial spread of infection. In Covid-19 pandemic this issue has been indicated to be even worse. Majority of reports suggested that a number of health workers have been infected with the virus from their respective work-places i.e. hospitals. This was the main reason for the high mortality rate in China, as the health system was weighed down because of infected health workers; appropriate medical help was not delivered. One of the studies carried out concluded that 1716 health workers were infected which accounted for 3.84% of total positive patients.⁸ Another study conducted by Wang et al concluded that 41% of cases were infected through nosocomial transmission.⁹ It has been suggested that the majority of treatments advocated for respiratory support can act as mediums for hospital-acquired infection spread. Some of these are high-flow nasal cannula, manual ventilation by resuscitator, intubation, bronchoscopy examination, suction, etc.¹⁰ Surprisingly, it was seen that a number of Covid-19 positive patients were encountered by spread that occurred through direct contact of health workers to the infected cases.⁵ Likewise, gatherings at public places and community levels like traveling, banquets, religious places, sports etc. were major reasons for the initial or pre-symptomatic spread of infection.¹¹⁻¹³

When it came to high-risk group individuals, it was found that people from all age groups, sex, race, community were infected with this infection. Some studies reported that 86.6% of the cases were found to be in the age range of 30 to 79years with mean age of 47years.⁹ As per one study it was reported that viral shedding was up to a minimum of 8days to 20days and maximum of 37days.¹

Modes of transmission

The origin of infection, mediums of spread, and vulnerable subjects are some of the necessary factors on which transmission of infectious diseases depends on. The outbreak of Covid-19 infection, thought to be started in December 2019, is still spreading. Hence the different patterns of transmission of this infection in the community are still to be discovered. The major transmission medium of Covid-19 is said to be by person to person transmission. Droplets from sneezes, cough, breathing aspirates, contacts and feces, and aerosols transmission can easily spread infection. This was given in accordance to the sixth version of the guidance for diagnosis and treatments for COVID-19 issued by the National Health Commission of China. A study conducted by Chan JF et al suggested that 6 members of the same family were tested Covid-19 positive. Out of them none were exposed to the China Animal market region rather two of them had visited a hospital with Covid-19 patients. It was observed that 58.3% patients are in Wuhan. These reports were given by China CDC that rest of the patients were imported from this city. Cases of vertical transmission have been reported in few studies but further research is required. No specific study revealed that newly born babies are not prone to this infection hence, infants must be protected in isolation wards for safety measures.⁵

Clinical symptoms

Mild respiratory disorder indications like cold, dry cough and fever along with malaise are few symptoms that a Covid-19 positive person will display according to WHO. The incubation period of COVID-19

disease is said to be reported by few studies as 5.2 days approx. after this incubation period the patient is known to show certain signs or symptoms. The duration from the beginning of this infection symptom to death varied from 6 to 41. This range was observed to be less in individuals above the age of 70 years as compared to those below the age of 70 years. Dry cough, fever and fatigue followed by breathlessness are some of the most common symptoms of this infection. Formation of sputum, hemoptysis, headache, lymphopenia and diarrhea are few of the other symptoms associated with Covid-19 infection which are said to develop in the later course of disease.³ Few of the respiratory disorder warning signs like dry cough, fever and dyspnea seen in Covid-19 infection are considered to be common indicators of the disease. These symptoms are found to be alike to the other two epidemic disease of SARS in 2003 and MERS in 2012 that strongly indicates droplet spread of infection and transmission by direct contact. On the other hand, nausea, diarrhea, vomiting, and abdominal distress that occur not more commonly are said to have a varied population difference, with an early and mild onset often followed by classic respiratory disease indications.¹⁴

The sequence of clinical symptoms in descending order from most common to least common are as follows—fever, cough, breathlessness or dyspnoea, myalgia, headache and diarrhoea.² Other symptoms included rhinorrhoea, sore throat and pharyngalgia according to studies reported in 4.0%, 5.1% and 17.4% of cases respectively. Few studies showed presence of leukopenia in certain cases along with a normal white blood cell count picture in most of the patients. Certain studies showed that the requirement of respiratory support measures was needed by patients of older age group more but this differed from few other studies.¹ Patients administered to intensive care unit (ICU) were majorly suffering from breathlessness as compared to the non-ICU patients. Cardiovascular disease, hypertension and diabetes mellitus were found to be the most common underlying or secondary debilitating diseases among adult age group cases.² Dyspnea or breathlessness was seen one week after the onset in patients with severe infection.¹ It was also observed that this infection lead to further lethal complications of metabolic acidosis, shock, ARDS, coagulation dysfunction and finally multiple system organ function failure.⁷ In unfavorably diseased cases dyspnea, anorexia and abdominal pain were also present. The display of fever symptoms varied from mild to moderate in infected individuals who were at a critical stage of the disease.¹

Increased levels of amino transferases, decreased levels of plasma proteins, and increased prothrombin time are few indications of liver damage or liver injury. These presentations have been reported in the prevailing clinical findings of this infection. When compared to percentage of liver damage in Covid-19 and SARS infection, SARS showed 60% of liver injury due to infection. In case of SARS the detection of liver infection was confirmed by presence of viral nucleic acids. Not so typical features such as fibrosis, presence of acidophilic bodies and hepatocyte ballooning were presented by methods like percutaneous biopsies of liver. Due to high intake of drugs like antibiotics, anti-viral drugs, etc. there are chances of drug toxicity associated liver injury or liver damage, also could be an over response of immune system as reported in studies. Though the exact effect of Covid-19 on liver is still to be discovered and confirmed. To one's surprise, expression of ACE2 was encountered in the hepatocytes (59.07 % of cell) suggestive of mild liver injury to the bile ducts.¹⁴ But further research is required for such a conclusion.

Radiological findings

CT is the most commonly used and accurate radiological technique in cases of covid-19 to study the chest findings. The most common chest radiographic findings are consolidations, opacities involving one or all the lobes of both the lungs. Most commonly seen cases had bilateral involvement. CT findings that were more frequently seen included bilateral and peripheral disease with consolidations, more lung involvement entirely, linear opacities, “crazy-paving” pattern and the “reverse halo” sign. Bernheim et al conducted a study to examine radiographic features seen in infected patients. It was found that bilateral lung involvement was seen in majority of the cases during all stages of infection with maximum percentage of involvement seen in the later stages.¹⁵

Laboratory diagnosis and potential treatment/ intervention

RT-PCR, sequencing of genomes and certain serological techniques like Enzyme-linked immunosorbent assay, commonly called as ELISA have been used for laboratory investigations of Covid-19 infection. This is with accompanying radio graphical assessment and clinical findings.⁵

Depending on the nature and changing patterns of the infection a varied range of treatment options have been carried out for the isolated patients. The first line of treatment delivered is certainly symptomatic treatment of these patients. In the present times there is no vaccination or any other particular anti-viral drug available as a potential treatment to treat this infection in human beings. As a result of which broad-spectrum antiviral medications have been administered and are in use as an initial therapy. These include like nucleoside analogues. Also, till the time any particular anti-viral drug is made available, drugs that might diminish the virus infection like HIV-protease inhibitors are being used.³ Ganciclovir, oseltamivir and lopinavir or ritonavir tablets are few of the anti-viral drugs prescribed as per study reports. It was also reported that 90% of the positive patients are administered with few broad-spectrum antibiotics.³

There is no effective standardized therapy for the Covid-19 illness till date. Lopinavir/ritonavir, neuraminidase inhibitors, nucleoside analogues, remdesivir, umifenovir, tenofovir, disoproxil and lamivudine which are DNA synthase inhibitors, chloroquine, traditional medicines from China, etc. are few of the drug groups that have been considered to be used as a therapy for treating this infection in human beings.² The pharmacological properties of Chloroquine has been described by certain studies to be associated with inhibition of few viral proteins resulting into inhibition of important pathways in viral replication/activation. One such example is inhibition of glycosylation in HIV (Human immunodeficiency virus). Chloroquine as a single drug or in addition with antiretroviral drugs can be effective in controlling the disease in HIV individuals has been suggested by few studies.¹⁴

Hydroxychloroquine has been widely used in many countries and proved to be effective.¹⁶ Few studies are being carried out to test the effectiveness of azithromycin in treating positive Covid-19 patients. One such study carried out by Gautret et al suggested that hydroxychloroquine is strongly related to diminishing the viral activity or load and its effect is enhanced in presence or in adjuvant to azithromycin drug.¹⁶ A number of studies are under progress to test the efficacy of azithromycin in controlling Covid-19 infection. Also,

use of convalescent plasma in treatment of this disease is under trials. Few studies have been carried out on the use of plasma transfusion in treating Covid-19 patients but there are certain limitations with the same.¹⁷ Hence, further clinical trials are needed to evaluate its efficacy and are said to be under progress.

Prevention and precautions

Infection control measures are of utmost importance in order to reduce the transmission of this infection and thereby control this huge global health crisis. For early prevention of infection spread it has been observed that history of traveling is a necessary factor to be taken into account than just clinical representation and radiographic presentations, which was evident from the SARS infection spread. To avoid spread of infection in health workers and surrounding family members, it is important to control person to person transmission. This can be achieved by social distancing or keeping away from infected surroundings. WHO has recommended few infection control measures on the basis of past outbreaks of SARS and MERS infection management. Regular washing of hands, sanitizing it from time to time after contact with infected surroundings, avoiding direct contact with positive patients, use of optimal protective measures like covering mouth with any cloth or mask and practicing personal cleanliness are few of the measures. People with any signs or symptoms of respiratory infection must follow personal hygiene like covering mouth while sneezing and coughing and also by reporting to the medical help as soon as possible. Also, infection prevention and control practices that are standardized are prescribed to be followed by health care units and hospitals.² Certain protocols and guidelines have been formulated by The US Centers for Disease Control and Prevention (CDC). These were implemented mainly to control and reduce the spread of infection in USA. Identification of patients and people that they came in contact with are few measures to be followed. Also, a detailed history of people coming from other parts of the world should be taken into account. Lastly, the accessibility to various fields through internet, media, news etc. has made it possible for everyone to share and exchange information. This can lead to formulation and spread of incorrect news and thereby initiate a panic situation. This should be avoided for the betterment of the humanity and the appropriate use of telecommunication must be implemented.

Conclusion

Considering the pattern of spread and deaths due to Covid-19 it has been observed that this infection is worse than SARS and MERS outbreak. Based on the initial nature of infection spread due to Covid-19 it can be said that the complications due to SARS-Cov-2 is more than the previous epidemic diseases. Another thought-provoking factor with respect to Covid-19 infection is the spread due to asymptomatic or silent carriers which is difficult to detect and control. Taking this into consideration a powerful prevention scrutiny is necessary for infection control. Adequate amount of appropriate nutritional diet, symptomatic therapy, and antiviral drug prescription are certain vital interventional procedures to be taken into account. Lastly, study and research on vaccination and prophylaxis is the need of the hour in further control of this infection.⁵ Considering the fact that this is a pandemic disease relatable precautionary measures needs to be taken at a global level in order to control its spread. Although very few pediatric patients have been detected positive, the role of covid-19 in all age groups must be a researched. Infection control is an individual responsibility & precisely followed. The chain from individual to society to state to country to world must be maintained in the form of social distancing to prevent the further spread of this

disease. All the governments are responsible for reaching every individual with accurate information and thereby avoiding any panic situation in the society & ultimately leading to healthy humankind.

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Conflicts of interest

No conflict of interest.

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