A New Threat to Mankind: COVID 19 - All You Need to Know

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Abstract: The devastating COVID 19 Pandemic, which set an outbreak by the end of 2019, has led the whole world into an alarming situation. So, considering the need of the time, we decided to put some light on the important aspects of the pandemic. Here we have discussed the different coronaviruses which can affect humans and also how this new coronavirus is different than the previously identified coronaviruses. In general, SARS CoV-2 is elaborated along with origin, virology, and transmission. The disease (COVID 19) is studied and briefed for its prognosis and symptoms and as to how the detection of the infection is done. As we know that we have not found any full proof solution for this outbreak but can fight it to save mankind, the need for new drug development and the current scenario on available options is discussed along with how the world is combatting the situation to stop its spread. Also, the common myths among the public about the disease are busted here. The paper is concluded with the current statistics of the outbreak. The purpose of this paper is to provide the general public with some know-how of the pandemic.

Keywords: SARS CoV-2, COVID 19, Coronaviruses (CoVs), pandemic, 2019nCoV, pneumonia, RT-PCR.

1. INTRODUCTION

Coronaviruses are a family of enveloped, single-stranded, positive-sense RNA viruses that are mainly found in bats and can affect many other species, including humans. The name corona was given to it as it resembles crown-like projections on the surface of the virus when seen under an electron microscope [1]. There are four main sub-groups of coronaviruses, known as α, β, γ, and δ. α and β CoVs are able to infect mammals, while γ and δ CoVs can infect birds [2]. Human coronaviruses were first identified in the mid-1960s [3]. There are seven coronaviruses that can infect humans [3]. People around the world commonly get infected with human coronaviruses 229E, NL63 (alpha coronavirus), OC43, and HKU1 (beta coronavirus) [2-4]. Other human beta coronaviruses are MERS-CoV, SARS-CoV, and SARS CoV-2 that cause middle east respiratory syndrome (MERS), severe acute respiratory syndrome (SARS), and coronavirus disease 2019 (COVID19), respectively [2]. These three recent viruses which used to infect animals have evolved to infect humans too [2-5]. The HCoV-229E strain is associated with common cold symptoms [6]. HCoV-NL63 infection causes mostly upper and sometimes lower respiratory tract infections, community-acquired pneumonia, and also croup (Spasmodic laryngitis) in children [7]. HCoV-OC43 infection has been associated mainly with the upper respiratory tract and aggravation of asthma and pneumonia in some groups and institutional settings [8]. HCoV-HKU1 has been associated with both upper and lower respiratory tract infections in children and adults [9]. MERS-CoV leads to respiratory infections ranging from asymptomatic to mild to fatal. MERS-CoV is transmitted sporadically from dromedary camels to humans and occasionally through human-to-human contact [10]. SARS-CoV is transmitted from civet cats to humans which is commonly associated with respiratory symptoms, fever, cough, shortness of breath, and breathing difficulties. More severe cases lead to an infection causing pneumonia, kidney failure, and even death [11].

1.1. Disease Caused by SARS CoV-2

It is a type of severe acute respiratory syndrome (SARS) characterised by fever and pneumonia. On 11 February 2020, Coronavirus Study Group (CSG) of the International Committee on Taxonomy of Viruses proposed to name the new coronavirus as SARS-CoV-2 [2]. The official name given to the disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is Coronavirus Disease (COVID-19) which was assigned by WHO [2, 12]. It was recognised as a pandemic by the World Health Organization (WHO) on March 11, 2020, and a Public Health Emergency of International Concern (PHEIC) [13].

This disease rapidly progresses to acute respiratory discomfort/distress which could turn out to be fatal.

2. ORIGIN AND TRANSMISSION OF SARS COV-2

It was first reported in Wuhan, Hubei province of China, which has subsequently affected 196 countries and territories around the world and 1 international conveyance (the Diamond Princess cruise harboured in Yokohama, Japan) with a death rate of 4.45% (as on March 24, 2020).
Since late December 2019, an outbreak of a novel coronavirus disease (COVID-19; previously known as 2019-nCoV) [14] emerged from the migration of people from infected countries across the world, making it a pandemic [14, 15].

Because it is a highly contagious disease, rapid screening and identification of the patients will allow prompt clinical treatments and patient management, and will also help establish a quarantine policy, thereby minimizing the risk of spreading the disease [16].

3. VIROLOGY

SARS-CoV-2 belongs to the beta CoV’s category. It has round or elliptic and often pleomorphic form, and a diameter of approximately 60-140 nm [17]. It has been proven that the genome of the new HCoV, isolated from a patient with atypical pneumonia who had visited Wuhan, had 89% nucleotide identity with bat SARS-like-CoVZXC21 and 82% with that of human SARS-CoV, so the new virus was called SARS-CoV-2. Its single-stranded RNA genome contains 29891 nucleotides, encoding for 9860 amino acids. Although its origins are not confirmed, these genomic analyses suggest that SARS-CoV-2 probably evolved from a strain found in bats. The Middle East respiratory syndrome (MERS) virus, another beta coronavirus, does not appear closely related, which rules out any linkage. The RNA sequence of SARS CoV-2 shows close resemblance to that of 2 bat coronaviruses, which tells us that they may be the primary source of transmission. But it is unknown how the virus got transmitted directly through bats or some other carrier (e.g., through an intermediate host) to humans [18]. Since the mutation in the original strain could have directly triggered virulence towards humans, it is not certain that this intermediary exists [17]. Phylogenetic analysis and DNA sequencing show that SARS CoV-2 is a beta coronavirus in the same subgenus (Sarbecovirus) as the SARS CoV (as well as several bat coronaviruses) but in a different clade. The apparent structure of the receptor-binding gene region is very similar to that of the SARS coronavirus, and there is a hypothesis that it will use the same receptor for cell entry [18].

Recently it is found that host entry of viruses requires spike protein (S) present on the viral surface (SARS CoV-2). The spike protein (S) and host cell receptor interaction are facilitated by cellular protease enzyme (cellular transmembrane protease serine 2). This allows SARS CoV-2 to occupy ACE2 (angiotensin-converting enzyme) as an entry receptor [19].

4. TRANSMISSION OF COVID 19

Based on the genetic study of the virus and phylogenetic analysis, the bat has been suspected as the origin of the virus, and SARS-CoV-2 might be transmitted from bats to humans via unknown carriers [2, 17]. Coronaviruses are zoonotic and are a large family of viruses that cause illness ranging from the common cold to more severe diseases, such as MERS and SARS and the recent pandemic COVID 19. The Health Commission of Hubei province, China, first reported a group of unexplained cases of pneumonia on Dec 31, 2019; 27 patients were initially reported, which was subsequently revised to 41 on Jan 11, 2020, with seven severe cases and one death. Some patients were reported to have radiographic ground-glass lung changes, normal or lower than average white blood cell and platelet counts, hypoxaemia, and lowered liver and renal function. Many of these patients were reported to be somehow linked to a large seafood and live-animal market (Huanan seafood wholesale market in Jianghan District, Wuhan, Hubei, China), suggesting zoonotic transmission [5, 20]. It was believed that those people who visited the seafood market may have become the source of transmission leading to the propagation of disease, but still, the primary source of infection remains unknown. But as the outbreak progressed, it was seen that the new cases had no contact with the seafood market but had direct contact with the COVID 19 patient and incubation carriers itself, such as the health care staff, relatives, and friends which depicted human-to-human transmission [2]. The SARS-CoV-2 is primarily transmitted from one person to another through respiratory droplets within 6 feet or 1 meter when an infected person coughs or sneezes, resembling the spread of influenza and also close contact with an infected patient. From the day of infection, it takes approximately 5-12 days for the symptoms to appear. Common symptoms are dry cough, fever, fatigue, and shortness of breath. The virus may remain on a surface or object and can enter by touch through nose, mouth, or eyes like other respiratory viruses. SARS-CoV-2 can remain active for up to 72 hrs on plastic and stainless steel, 4 hrs on copper, 24 hrs on cardboard, and for 3 hours in aerosols [21].

Understanding of the transmission risk is incomplete. However, as the transmission mechanisms are not certain, airborne precautions are to be practiced routinely in affected countries [18].

5. PROGNOSIS AND SYMPTOMS

Common signs of infection include respiratory symptoms, fever, cough, fatigue, shortness of breath, and breathing difficulties. In more severe cases, the infection can cause pneumonia, severe acute respiratory syndrome, loss of speech or movement, chest pain or pressure, kidney failure, and even death. Also, some patients show loss of taste or smell, conjunctivitis, a rash on the skin, or discolouration of fingers or toes, diarrhoea [11]. According to the CDC (Cen-

<table>
<thead>
<tr>
<th>Infection period:</th>
<th>Standard 14 days Quarantine period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14</td>
</tr>
<tr>
<td></td>
<td>“Viral shedding” – Ability to infect others until cured</td>
</tr>
<tr>
<td>Symptoms appears</td>
<td></td>
</tr>
</tbody>
</table>
tes for disease control and prevention), the incubation period is usually between 1-14 days and the typical symptoms are fever, dry cough, fatigue and gradual appearance of dyspnoea [22].

It can take 2 to 14 days (Standard Quarantine Period) for a person to develop symptoms after being exposed to the virus. The average is about 5 days.

Once it enters the body, it attacks the epithelial cells in the inner linings of the lungs. A spike (S) protein on the surface of the virus can attach to a receptor of the host’s cells, thereby facilitating the penetration. After penetration, the virus replicates until it kills the host cell. This process takes place in the upper respiratory tract, primarily. At this stage, the viral infection starts showing flu-like symptoms such as dry cough, shortness of breath, fever, headache, and fatigue. In milder cases, the host’s immune system stops the virus in the upper respiratory tract itself. The infection advances as the virus treks down the trachea and enters the lower respiratory tract making the symptoms more severe, and it prefers growing in the lungs as they are the major target. More respiratory complications like bronchitis and pneumonia occur as the virus goes down the trachea into the lungs and continues to replicate. Dyspnoea combined with cough is the characteristic of Pneumonia affecting the alveoli. The alveoli are tiny air sacs where oxygen and carbon dioxide are exchanged from the blood. During Pneumonia, the alveolar cells get damaged by the virus. The immune system reacts by sending soldier cells to the lungs to fight off the virus which eventually makes the linings of the lungs thicker than normal, choking off the little air pockets, which is where the oxygen gets exchanged. Low levels of oxygen in the bloodstream do not supply an ample amount of oxygen to the vital organs, which include the liver, kidney, and brain. In worse cases, COVID-19 can lead to acute respiratory distress syndrome (ARDS), which causes respiratory failure, septic shock, or multi-organ failure which may be fatal [22].

6. DIAGNOSIS OF COVID 19

Signs and symptoms of COVID 19 are highly non-specific like fever, cough, dyspnoea, pneumonia, and in some cases, diarrhoea, thus urgent screening of patients and diagnostic testing is required to confirm the suspected cases. Diagnosis of SARS-CoV-2 caused Coronavirus disease 19 (COVID 19) was based on the protocol released by the World Health Organization [24]. In current times, a widely used test for SARS-CoV-2 diagnosis is RT-PCR (Real-time Reverse Transcriptase Polymerase Chain Reaction) [25, 26]. A technique that is used to quantify the nucleic acid (DNA/RNA) present in a sample during the PCR reaction is called real-time PCR or quantitative (q)PCR. Once someone is identified as a suspected or person under investigation (by thermal scanning or symptomatic identification), nasopharyngeal swab or sputum sample is collected for pathogenic testing. This laboratory technology is based on real-time RT-PCR and sequencing of nucleic acid from the virus [25, 27-29]. In this method, RNA is first transcribed into complementary DNA (cDNA) by reverse transcriptase from total RNA or messenger RNA (mRNA). The cDNA is then used as the template for the qPCR reaction. Two general methods for quantitative detection have been implicated: first, a gene-specific fluorescent probe or specific double-strand (ds)DNA binding agent and second, non-sequence specific fluorescent intercalating (ds)DNA binding dye [28, 29]. The data thus generated from the above two methods can be analysed by computer software to calculate relative gene expression (or mRNA copy number) in several samples. The diagnosis of SARS-CoV-2 infection by RT-PCR in clinical samples like sputum, respiratory aspirate, or nasopharyngeal swab obtained from the patient allows us to make an early diagnosis of the COVID 19 [25, 26]. But the reproducibility of RT-PCR tests depends on factors like methodology, disease development stages, specimen collection methods, quality of testing kits available in the affected area, and nucleic acid extraction methods from specimen samples. Because of all these mentioned factors, tests should be repeated many times in several cases before confirmation. Other tests for diagnosis of COVID 19 include radiological imaging and CT images, including ground-glass opacities [22, 30].

7. DRUG TREATMENT OPTIONS FOR SARS COV-2 CORONA VIRUS DISEASE (COVID 19)

Till date, no effective treatment such as vaccines or antivirals is available to treat Coronavirus infection. The surface protein or the (S) spike of the coronavirus plays an important role in cell penetration, hence it should be taken into consideration while developing the antivirals or any sort of treatment [19]. Because of the complexity in coronavirus structures, there are multiple challenges in the disease treatment. But still, several ways that can yield potential drugs to treat coronavirus infections are being researched using multiple methods. The first method includes in-vitro testing of the existing antiviral drugs which are used for the treatment of other infections [31]. The second method is to sort out already existing chemical compounds from chemical library or databases which include information about transcription characteristics in different cell lines and then further evaluate these compounds by antiviral assays. The third method involves the modification of therapeutic compounds by understanding genomic and biologic characteristics of coronaviruses. So far, there has been no effective treatment for COVID 19. Several potential drugs that treat other viral infections such as ribavirin, lopinavir-ritonavir, corticosteroids, neuraminidase inhibitors like remdesivir, oseltamivir, favipiravir, paromivir, and DNA Synthesis inhibitors chloroquine and hydroxychloroquine are being used in patients with SARS CoV-2 [32]. Antiviral drugs remdesivir and Tocilizumab are in Phase 4 clinical trial and Hydroxychloroquine is in Phase 3 clinical trial for the treatment of COVID-19 [33].

Future prospective: On March 16, 2020, the first clinical trial of a vaccine was done in Seattle on 4 volunteers. The vaccine contained a harmless genetic code copied from SARS CoV-2 [34]. Much more studies and research are being carried out to find a sure solution for this worldwide threat.

8. PROSPECTS FOR CONTROLLING SARS COV-2 / PREVENTIVE MEASURES

The outbreak of COVID 19 and the need for arresting the rapid spread of the virus bring attention to important aspects
in order to keep a check on emerging viral respiratory infections. These aspects include quick detection, isolation of suspected people, effective contact tracing, and the basic infection control practices [11, 12]. If the contact tracing, case identification, and quarantine is not done within 3 days, the effectiveness of isolation is affected adversely [35].

SARS CoV-2 enters the body via eyes, nose, and mouth, so touching the face with unwashed hands must be avoided. Hands should be washed with soap and water for at least 20 seconds or should be cleaned with alcohol-based sanitizers, gels, or tissues.

Like other CoVs, it is sensitive to ultraviolet rays and heat. Furthermore, these viruses can be effectively inactivated by lipid solvents such as ethyl alcohol, ether, peroxycetic acid, disinfectants containing chlorine, and chloroform, except for chlorhexidine [17].

One should keep a distance of at least 1 meter from a suspected COVID-19 infected person who shows symptoms to reduce the risk of infection through respiratory droplets which may be passed on while sneezing or coughing [36]. Considering the severity of this pandemic outbreak, governments of different nations have taken precautionary measures such as work from home, closing of schools and colleges, limitations on transport, avoiding mass meets, cancelling or postponing public events, making people aware about self-quarantine and isolation, etc.

9. SOME BELIEFS BROUGHT TO LIGHT

**Q:** Can the COVID-19 virus be transmitted in areas with hot and humid climates?

**A:** From the evidence so far, SARS CoV-2 can be transmitted in all areas, including areas with hot and humid weather. So, an increase in the environmental temperatures does not seem to affect or reduce the propagation of the virus which is contrary to the belief.

**Q:** Are thermal scanners effective in detecting people infected with SARS CoV-2?

**A:** Thermal scanners can detect only people who have a fever (i.e., elevated body temperature) because of viral infection from SARS CoV-2. But they cannot detect infected people that have not yet developed any symptoms like elevated temperature. This is because symptoms may be seen from 2 to 10 days of infection.

**Q:** Can antibiotics be used for preventing or treating COVID 19?

**A:** No, antibiotics are effective only against bacterial infections, so they cannot be used against viral infections (in this case, COVID 19). Antibiotics may be used in the case of co-infection (bacterial) during the incubation period [37].

**Q:** Should everyone wear a mask?

**A:** Mask should only be worn if a person is ill and shows COVID-19 symptoms (especially coughing) or while taking care of a person who may have caught COVID-19. A disposable face mask can only be used once. A person who is not ill or not a caretaker is just wasting a valuable mask which is short worldwide, so it is advised by WHO to use masks wisely. Also, the use of masks may sometimes make a person so much carefree or rather careless that they may easily catch the infection by unknowingly touching their face [38].

**Q:** Can SARS CoV-2 be transmitted by eating meat?

**A:** Coronaviruses are thermolabile, which means that they are susceptible to normal cooking temperatures (70°C). Therefore, as a general rule, the consumption of raw or undercooked animal products should be avoided. Raw meat, raw milk, or raw animal organs should be handled with care to avoid cross-contamination with uncooked foods [39].

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Country, Other</th>
<th>Total Cases</th>
<th>Total Deaths</th>
<th>Total Recovered</th>
<th>Tot Cases/ 1M pop</th>
<th>Deaths/ 1M pop</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>USA</td>
<td>3,906,812</td>
<td>143,349</td>
<td>1,802,552</td>
<td>433</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Brazil</td>
<td>2,100,112</td>
<td>79,535</td>
<td>1,371,229</td>
<td>374</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>India</td>
<td>1,132,475</td>
<td>27,707</td>
<td>709,817</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Russia</td>
<td>777,486</td>
<td>12,427</td>
<td>553,602</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>South Africa</td>
<td>364,328</td>
<td>5,033</td>
<td>191,059</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Peru</td>
<td>353,590</td>
<td>13,187</td>
<td>241,955</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Mexico</td>
<td>344,224</td>
<td>39,184</td>
<td>217,423</td>
<td>304</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Chile</td>
<td>333,029</td>
<td>8,633</td>
<td>303,992</td>
<td>451</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Spain</td>
<td>307,335</td>
<td>28,420</td>
<td>N/A</td>
<td>6,573</td>
<td>608</td>
</tr>
<tr>
<td>10</td>
<td>UK</td>
<td>295,372</td>
<td>45,312</td>
<td>N/A</td>
<td>4,350</td>
<td>667</td>
</tr>
</tbody>
</table>

(as of 20th July 2020, GMT 15:45)
10. COVID 19 PANDEMIC STATISTICS BASED DISCUSSION

(This data was obtained from Worldometers.com) [40].

The pandemic COVID-19 is affecting 213 countries and territories around the world and 2 international conveyances. We have listed down some of the majorly affected countries in Table 1. Deaths were also noted according to Age, Sex, and Comorbidity. Studying the age wise statistics as in Table 2, it was concluded that, in general, children seem to be less affected. Younger patients have a better immune response as compared to older patients. Considering the sex of the affected people, it was seen that the death ratio in males was more than that in females (Table 3). It must be taken into consideration that smoking is much common among males. Smoking increases the risks of respiratory complications. This is the reason that males show more death rates as compared to females. The most important aspect to be considered for studying the death ratio is comorbidity. Table 4 shows that people with pre-existing conditions are more susceptible to COVID 19 and also show a higher death rate.

![Table 2: Age-wise statistics.](image)

<table>
<thead>
<tr>
<th>Age (in Years)</th>
<th>Death Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 and above</td>
<td>14.8</td>
</tr>
<tr>
<td>70 to 79</td>
<td>8.0</td>
</tr>
<tr>
<td>60 to 69</td>
<td>3.6</td>
</tr>
<tr>
<td>50 to 59</td>
<td>1.3</td>
</tr>
<tr>
<td>40 to 49</td>
<td>0.4</td>
</tr>
<tr>
<td>30 to 39</td>
<td>0.2</td>
</tr>
<tr>
<td>20 to 29</td>
<td>0.2</td>
</tr>
<tr>
<td>10 to 19</td>
<td>0.2</td>
</tr>
<tr>
<td>0 to 9</td>
<td>no fatalities</td>
</tr>
</tbody>
</table>

(*Death Rate = (number of deaths / number of cases))
(Last updated 29th February 2020)

![Table 3: Sex wise statistics.](image)

<table>
<thead>
<tr>
<th>Sex</th>
<th>Death Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>2.8</td>
</tr>
<tr>
<td>Female</td>
<td>1.7</td>
</tr>
</tbody>
</table>

(*Death Rate = (number of deaths / number of cases))
(Last updated 29th February 2020).

![Table 4: COVID-19 fatality rate by comorbidity (existing conditions).](image)

<table>
<thead>
<tr>
<th>Pre-Existing Condition</th>
<th>Death Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular disease</td>
<td>10.5</td>
</tr>
<tr>
<td>Diabetes</td>
<td>7.3</td>
</tr>
<tr>
<td>Chronic respiratory disease</td>
<td>6.3</td>
</tr>
<tr>
<td>Hypertension</td>
<td>6.0</td>
</tr>
<tr>
<td>Cancer</td>
<td>5.6</td>
</tr>
<tr>
<td>no pre-existing conditions</td>
<td>0.9</td>
</tr>
</tbody>
</table>

(*Death Rate = (number of deaths / number of cases))
(Last updated 29th February 2020).

CONCLUSION

The outbreak of COVID-19 spread rapidly and has affected 213 countries/territories/areas across the world. [40] Researchers have made efforts in the characterization of the SARS CoV-2 and are extensively working on the therapies and vaccines against the virus. We have summarized current knowledge on COVID-19; firstly, infection caused by SARS...
CoV-2 has a high potential for infectivity as compared to SARS and MERS in terms of morbidity and mortality. Secondly, the susceptible population involves the elderly and people with pre-existing medical conditions, which requires more attention and care. Thirdly till now, supporting treatments with antiviral agents such as remdesivir, lopinavir/ritonavir and some antimalarials such as hydroxychloroquine and chloroquine have shown definite effects on COVID-19 patients, while solid data are needed from clinical trials. However, questions remain unanswered and more studies are required to explore the transmission and pathogenesis mechanism of the coronavirus. Additionally, to reveal the molecular mechanisms of viral entry and replication, further research is needed on the development of targeted antiviral drugs and vaccines.

CONSENT FOR PUBLICATION

Not applicable.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

Declared none.

REFERENCES


