The COVID-19 pandemic is real. The outbreak of the virus has proved to be a life threat to humans. At the end of December 2019, Wuhan city of Hubei province in central China, alledation severe cases of pneumonia of unknown origin. As of June 2020, there were 10.3M confirmed cases across worldwide with 506K death. On 7 January 2020, a human sample from the throat swab of a patient identified the novel coronavirus by Chinese authorities. Later, the pathogen was renamed as SARS-CoV-2 and the disease as coronaviruses disease 2019. On 30 January 2020, WHO declared the SARS-CoV-2 outbreak as an Public Health Emergency of International Concern (PHEIC ). The causative virus belonged to the family coronaviridae, a member of the β group of coronavirus. In 2003, over 26 countries reeled under SARS CoV infected 8098 people with rate of mortality 9 %. However, till the date of this writing, the novel coronavirus 2019 infected 10.3M people with mortality rate of 4.8% over 109 countries. It showed that the spreading rate of SARS – CoV-2 seemed to be greater than SARS-
CoV^2^7. This review makes use of combing research article, multiple origin & social media posts. In this review article, we briefly summarize the genetic morphological structure, pathogenesis, mode of transmission, treatment strategy, laboratory diagnosis as well as future perspective.

**GENETIC MORPHOLOGY OF CORONAVIRUS**

This virus is also very similar to the previous SARS Coronavirus and is therefore named as SARS-CoV-2. SARS-CoV-2 is a helical symmetry, positive sense single stranded large RNA viruses under the family Coronaviridae, order Nidovirales and enveloped in a lipid bilayer membrane, sensitive to lipid solvent, having genome size of approximately 30kb^9. There are four major genera of Coronavirus and are categorized into – the alpha and beta – which originated from rodents and bats, gamma and delta coronavirus – which originated from avian species. SARS-CoV-2 belongs to the genus β – coronavirus. The first two groups of coronaviruses primarily infect mammals whereas the latter two groups mainly infect birds^9^11. In the recent study, it has been shown that Angiotensin Converting Enzyme 2 receptor expressed by lung epithelial cells, kidney, blood vessels is used by SARS-CoV-2 to gain entry into the human cells^12. The Coronavirus virions contains several structural proteins including the Spike protein (S), the Transmembrane protein (M), the Envelope protein (E), the Nucleocapsid protein (N), few coronaviruses contain the Hemagglutinin Esterase (HE) and several non-structural proteins (nsp) are also encoded by it (Fig 1). Both Transmembrane protein M & Envelope protein E are involved in virus gathering processes^9. The N protein is responsible for the formation of nucleocapsid by coating RNA, necessary for RNA synthesis and it binds to the CoV genome and soluble in nature. It also plays a crucial role in the viral RNA replication process and cellular response to viral infection against the host. Expression of N protein increase the production of virus like particles as shown by a recent study^13. The S glycoprotein of the coronavirus is responsible for the petal shaped or crown like projection on their surface from which the name “Coronavirus” was coined, is found in the virion envelope^11^13. Furin like proteases cleaves the S protein into two different functional domain viz S1 – amino and S2 – carboxy terminal. The N terminal S1 domain is involved in receptor binding function whereas C terminal S2 transmembrane protein are involved in viral entry^14. S1 Spike protein primarily help the virion to attach with the Peptidase domain of host receptor (ACE2) and internalization of the virus inside the host cell induces conformational change in the S glycoprotein. S2 Spike proteins involve in the process of fusion of the virion and cellular membrane. The S protein is the main inducer of neutralizing Antibody^14,16. The most plentiful structural protein is the membrane glycoprotein responsible for helping the formation of new virus particles by joining virus & host factors. However, in Reverse genetic studies it has been shown that by interacting M protein with the viral ribonucleoprotein and glycoprotein it generates a bridge of M-M interaction having capability to keep out some host membrane proteins from the viral site^17.

**PATHOGENESIS**

The exact mechanism by which SARS-CoV-2 developed COVID-19 is not known yet. Severely infected Covid-19 patients showed high level of leukocytes counts, respiratory problems, high level of plasma proinflammatory cytokines. In a case report of covid-19, it was seen that a patient developed high body temperature along with cough at 5 days having breathing problems in both lungs of covid-19 patients^20. RT-PCR showed positive result from patient sputum sample that confirmed the presence of nucleic acid of SARS-CoV-2^20. The laboratory finding revealed that, a blood C- reactive protein level was higher (16.6 mg/L) than the normal range (0- 10 mg/L). Also, D- dimer and erythrocyte sedimentation rate was also markup in these patients^21. The main primary mechanism of covid-19 pathogenesis was severe pneumonia but there are some other complication like anemia, acute cardiac injury and incidence of ground glass opacities have been identified in subpleural regions of both lungs that leads to death. However, significantly high up blood level of chemokines & cytokines including IL-1 Ra, IL-7, IL-8, IL-9, IL-10, IL-1β, GCSF, basic FGF2, IP-10, MCP1, TNFα, VEGF-A is also associated with covid-19 patients^21. High level of proinflammatory cytokines including IL-2, IL-7, IL-10, MCP1, MIP -1α, GCSF & TNFα upraised in patients with severe cases admitted in ICU^22. Angiotensin Converting Enzyme 2 (ACE2) play a key role to initiate the process of pathogenesis of covid-19 infection. SARS-CoV-2 utilized ACE2 as a host receptor. The S glycoprotein of the coronavirus can bind to the ACE2 receptor which are responsible
for the entry of virus into the host cells. S glycoprotein consists of two subunits viz S1 and S2. After binding to ACE2 receptors, infection generally starts with cells of the respiratory mucosa and then spread to epithelial cells of alveoli in the lungs. Receptor binding causes conformational changes in the S protein followed by fusion of viral membrane with host cell membrane with the help of serine protease like TMPRSS2 or Cathepsin which results in release of the viral genome (made up of RNA) and nucleocapsid protein inside the cells. Then, the virus uses the host cell machinery to replicates its genome, producing viral RNA and proteins. Finally, viral protein, genomic RNA, nucleocapsid protein merge together to produce a new copy of the virus particles called mature virion in the cytoplasm and then transported via golgi vesicles & they break out from the cell through the process exocytosis and the host cell dies (Fig 2). Rapid fast growth of the virus slowly destroyed tissue, producing symptoms. Inflammatory response is triggered by infection, which assembled the immune cells to the site to fight against the virus. Inflammation is an important defense mechanism, it may become enormous causes damaged to the own body tissues leads to the severity of the disease.

TRANSMISSION

The first positive COVID-19 cases were reported in Wuhan, China linked to a wet animals wholesale seafood market suggested that SARS-CoV-2 was transfer from animals to human. The rapid spread of COVID-19 infection is from aerosol droplets, respiratory droplets, close contacts & fomites. The mean incubation period was 3-9 days with a range between 0-24 days. When a covid-19 person...
coughs or sneezes, transmission is possible through respiratory droplets. When the person sneezes, the droplets come out and get mixed with air to form an aerosol. Once inhaled it may cause infection. A recent study showed that ocular surface having high potential to carry out the highly pathogenic SARS-CoV-2 infection. Other modes of transmission include hand shaking with infected person. If anyone comes in contact with infected person and then repeatedly touches the mouth, nose, eyes there might be a possible chance of transmission. In a hospital study of 138 covid-19 patients, 41% cases are associated with hospital associated transmission of SARS-CoV-2.

In retrospective study it was found and confirmed that there is no possible way of transmission in third trimester covid-19 pregnant patients from mother to baby. Even though pregnant women underwent cesarean section, so there is a possibility of transmission during vaginal delivery was yet to be predicted. As a result pregnant women are exposed to severe respiratory infection. However, another study of 425 patients found that the ratio of SARS-CoV-2 infection gradually increased in healthcare workers. Outside China, as of June 30, 2020 there were 591,001 confirmed cases reported in India of which the first case was reported in Thrissur kerala on January 30.

**CLINICAL SYMPTOM SPECTRUM**

The observation clinical symptoms of covid-19 infection is very essential, the symptoms are non specific & the most common symptoms includes dry cough, dyspnoea, fever, fatigue & myalgia. Severe rapid organ dysfunction have been reported such as shock, acute ARDS, arrhythmia, acute cardiac injury & even death. A study on 99 patients showed that 11% patients died of rapid organ failure & 17% patients developed acute respiratory distress syndrome.

Pregnant & non pregnant women should have almost identical characteristics. Gastrointestinal problems like diarrhoea have been reported in corona infected patients. Although symptoms like sneezing, sore throat and rhinorrhea are associated with covid-19 as it target the lower airway respiratoty tract.

**LABORATORY DIAGNOSIS**

Due to limited number of testing kits, well established laboratory many developing countries as well as in low income countries it will be quite tough for them to arrange all this facilities. Presently, available diagnostics tools for infected patients in laboratory include RT-PCR to confirm the presence of nucleic acid of SARS-CoV-2 in sputum, naso & oropharyngeal swabs, isolation of virus from human clinical specimen (viral cell culture technique), perform certain immunological assay for the detection of antibody & antigen include ELISA, rapid immune chromatographic test etc. So, these methods are very expensive and time consuming. A positive test generally indicate the presence of covid-19, although sometimes false positive test are also generated because of the mutation in the genome of SARS-CoV-2. If initial testing show negative results but the apprehensive remains for covid-19, then recommended WHO guideline testing procedure from different respiratory tract. Some other laboratory test may include analysis of CD4+ & CD8+ count by flow cytometry, serological biochemistry, chest radiological finding (pneumonia), total blood picture (lymphopenia). Sometimes, coinfection with more than one virus has been noted & have an influence on management decision.

**COMPLICATIONS**

Laboratory data mark common peculiarity among covid-19 patients including high level of lactate dehydrogenase, high level of alanine aminotransferase, high level of D-dimer, high level of neutrophils, eosinopenia, lymphopenia, high level of CRP. The eosinopenia is associated with covid-19 patients while its sensitivity & specificity are low. Both lymphopenia & eosinopenia change the sensitivity and specific pattern. COVID-19 patients have significantly high level of TNFα, VEGF A, MCP-1, GCSF. High level of troponin indicate infiltration of cardiac tissue. Table 1 exhibit the most frequent finding are eosinopenia & lymphopenia with 78.8% and 68.7%.

Elevated levels of Urea and Cystatin-C in severe COVID-19 patients causes acute kidney injury. There are two principles behind the causes of acute kidney injury. The first theory is from production of more ACE2 levels in the proximal convoluted tubules than the lungs or heart. The second theory related to cytokine storm. Elevated levels of Troponin is encountered in 17.3% patients.
associated with ventricular tachycardia, malignant arrhythmia\textsuperscript{65, 60, 61}. Most of the comorbidity associated with COVID-19 is hypertension (30.7%), then Diabetes mellitus (14.3%) followed by Cardiovascular disease (11.9%). Heart failure is also seen with elevated levels of N-terminal pro B type natriuretic and troponin levels, mainly in severe associated cases\textsuperscript{62}. A recent published study showed high up level of troponin in severe cases\textsuperscript{63}.

Table 1: COVID-19 Laboratory detection data

<table>
<thead>
<tr>
<th>Laboratory Detection</th>
<th>Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eosinopenia</td>
<td>78.8</td>
</tr>
<tr>
<td>Lymphopenia</td>
<td>68.7</td>
</tr>
<tr>
<td>Elevated AST</td>
<td>63.4</td>
</tr>
<tr>
<td>Elevated CRP</td>
<td>60.7</td>
</tr>
<tr>
<td>Elevated PT</td>
<td>58.0</td>
</tr>
<tr>
<td>Elevated LDH</td>
<td>47.2</td>
</tr>
<tr>
<td>Elevated D-dimer</td>
<td>46.4</td>
</tr>
<tr>
<td>Thrombocytopenia</td>
<td>36.2</td>
</tr>
<tr>
<td>Elevated ALT</td>
<td>21.3</td>
</tr>
<tr>
<td>Elevated HS Troponin</td>
<td>12.5</td>
</tr>
</tbody>
</table>

LDH – Lactate Dehydrogenase; AST – Aspartate Aminotransferase; PT- Prothrombin time; CRP – C- reactive protein; HS- Troponin – High – sensitivity Troponin

**POTENTIAL THERAPEUTIC STRATEGIES**

Currently, there is no primary standard care for covid-19. However, research studies are still going on to develop vaccines against covid-19. Development of vaccines takes a long time and it will require several clinical evaluations\textsuperscript{64}. The only available therapeutic option mainly focused on symptomatic and supportive care of covid-19 patients as per the guideline. At present covid-19 patient is being treated with antiviral drugs like lopinavir and ritonavir (400mg twice each day and 100 mg twice every day) and Arbidol (200mg two times every day) is suggested but the clinical effectiveness has not been investigated properly yet\textsuperscript{45}. The researchers considered the S protein as a target molecule for developing drugs. Oral and intravenous administration of quinolones and cephalosporins antibiotics is given if fever lasted for more than 7 days or elevated level of C-reactive protein i.e. 30mg/L or more (normal range: 0-8mg/L)\textsuperscript{45}. In the United State, a study demonstrated that Remdesivir being effective in treating covid-19 patients and show good invito results\textsuperscript{27}.

Another study shown, combination of both Remdesivir and Choloroquine antagonizing the in vitro replication process of SARS-CoV-2\textsuperscript{29}. A study from South Korea, upon administration of lopinavir/ritonavir treatment showed notably reduced SARS-CoV-2 infection in covid-19 patients\textsuperscript{62}. Assessment on the efficiency and safety of Lopinavir and Ritonavir in covid-19 patient is still ongoing\textsuperscript{64}. In most of the patients, combination of both Lopinavir-Ritonavir effectively clearing the viral load. Ritonavir inhibit the CYP3A4 while this enzyme inactivates Lopinavir and achilles tendinopathy has been reported while taking above combination\textsuperscript{65, 66}. High dose of Vit-C has also been recommended to treat covid-19\textsuperscript{67}. According to several published studies, Convalescent Plasma Therapy are suggested for the treatment of covid-19. Administration of convalescent plasma from infected recovered patients showed encouraging promising results\textsuperscript{68}. Possible risk factors associated with plasma therapy – Anaphylactic Reactions, Acute lung injury, RBC alloimmunization, Hemolytic transfusion reaction\textsuperscript{69}. During treatment, care should be taken to minimize the chance of transmission and reduce complication\textsuperscript{70}. Now it is very clear that more research is required to identify the drug for treating of covid-19 infection\textsuperscript{71}. Griffithsin, an inhibitors of spike glycoproteins have been reported to bind to SARS-CoV-2 glycoproteins by inhibiting the interaction with ACE2 receptor. Recently, India has successfully developed a potential indigenous vaccine candidate name “COVAXIN” in alliance with the Indian Council of Medical Research – National Institute of Virology. The DCGI has been given permission to conduct phase 1 and 2 human clinical trial\textsuperscript{72}.

**FUTURE PERSPECTIVE**

Mostly countries like China, India, Italy and USA as a result of pandemic 2019 it is seen that they are in declining state in several aspects like health, social and economic sectors. The developed countries already facing this pandemic seems to face a...
catastrophic perspective where as in low income countries it will be quite tough for them to afford this viral emergency and the consequences will be catastrophic\textsuperscript{29}. In 2003, similarly the global outbreak of SARS-CoV, also the covid-19 will not affect Africa or south America on a large scale suggesting that respiratory viruses spread more effectively in the winter and therefore the southern hemisphere will be affected later. This can also act different according to climate differences, effects of UV on the survival of viruses, immunological differences etc\textsuperscript{73}. By maintaining the hygiene and taking the preventive measures we can lower the rate of spread. To fight the current pandemic situation requires certain steps to reduce the transmission rate from person to person. Special need should be given to protect the elderly patients, infants, medical staff etc\textsuperscript{74}. Most of the countries like US, India, UAE have executed country wise lockdown and proper travel screening as a preventive measure to minimize the transmission. Till now, a number of things remain unclear, focused or questioned. As far now, only few pediatric cases have been reported may be because of lack of insufficient testing\textsuperscript{39}.

CONCLUSION

COVID-19 has taken many lives of human and the death count still continues. Everyday the death toll is rising in rapid pace because no specific treatment is available for this disease, so only preventive measures is there to follow the guidelines recommended by government. Several vaccines are under development. All the scientist, researchers, pharmaceutical companies are working day and night to find out possible medication for the cure and we can hope that they will succeed soon. Doctors, paramedics staffs are trying their level best to give comfort to the patients in hospital. For now, they are our savior. The most practical yet simple way to fight the pandemic is to maintain a hygienic life and maintaining social distancing. Government is also trying its best to keep us safe. For that they are providing various guidelines. So as a good and responsible citizen of India we should follow the guidelines to keep ourselves, our family and our country safe. Let us hope for the best that the pandemic ends soon and we are able to get back to our normal life.

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CONFLICT OF INTEREST

There are no conflicts of interest.

AUTHOR’S CONTRIBUTIONS

BB and AMAI collected data and drafted the paper under supervision of RKS. All authors read and approved the paper for publication.

REFERENCES


Ikbal et al., Insight into Severe Acute Respiratory Syndrome Coronavirus-2


43. Xu XW, Wu X, Jiang XG. Clinical findings in a group of patients infected with the 2019 novel coronavirus (SARS-CoV-2) outside of Wuhan, China: retrospective case series. BMJ. 2020; 368: m606.


