IRJSE International Research Journal of Science & Engineering
Int. Res. J. of Science & Engineering, Volume 8 (3) 2020
ISSN: 2322-0015
SJIF Impact Factor 6.70
RESEARCH ARTICLE
OPEN ACCESS

Sars COV-2: Complete review on Global pandemic (COVID-19)

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Manuscript Details

Received :24.04.2020
Accepted : 06.05.2020
Published :30.06.2020

Available online on https://www.irjse.in
ISSN: 2322-0015

Editor: Dr. Arvind Chavhan

Cite this article as:
Praveen Kumar Gupta, Rithu BS, Kauser Banu, Shruthi A and Sahana C. Sars COV-2: Complete review on Global pandemic (COVID-19), *Int. Res. Journal of Science & Engineering*, 2020, *Volume 8(3): 101-108.*

Abstract

emergency world wide due to public health crisis and life-threatening situation. According to recent study it has be reported that the virus was found originated in animal and transmitted to humans though a food chain. First case was reported in Wuhan-china on December 2019, In this review we have enlightened on different aspects of novel corona virus 2019 and measure to combat the battle against the novel corona virus 2019.

Keyword: SARS COV 2, Life threatening, combat battle against virus.

1. Introduction

Coronaviruses represents a group/family of related viruses that cause diseases in mammals and birds [1]. It is a most deadly pathogen, that causes acute and mild respiratory infection in human [2,3]. The history of first human coronavirus (HCoV) outbreak was found in the year 1965, followed by two more pandemic outbreaks of global and economic health emergencies [3]: Severe acute respiratory syndrome coronavirus (SARS-CoV) in 2003 and Middle East respiratory syndrome coronavirus (MERSCoV) in 2012. Therefore COVID-19/2019-nCoV/SARS-CoV-2 is a newly discovered coronavirus in the year 2019 [3,4] which belongs to the family of Coronaviridae and comprises crown-shape single strand RNA virus with 80-160 nM in size and 27-32 kb positive polarity [4-9]. The first case of Novel COVID-19 was detected in Wuhan, which is the large city of 10.76 million inhabitants and the capital of Hubei province.

It is Located in the heartland of China, also known as the major transportation hub. During the month of December 2019, a case of pneumonia was reported at Seafood Market in Wuhan, followed by series of pneumonia cases with the unknown cause, then by the first week of Jan 2020, the Chinese centre for disease control and prevention (CDC) identified the novel coronavirus from the throat swab sample of these patients, and named it as 2019 novel coronavirus (2019-nCoV) [10]. Initially the number of cases were less and the rate of propagation was slow, but sooner the number of cases started increasing exponentially which indicated the fact of human-to-human transmission also known as local transmission. These cases were not only detected in the other regions of China, but it's also found predominantly in other countries who have recently travelled to China leading to the community transmission and the epidemic conditions [12]. Due this pandemic situation the World health organisation (WHO) declared the outbreak as Public Health Emergency of International Concern on 30 January 2020. And on 11 February 2020, WHO announced it as the new coronavirus disease: COVID-19 [11]. Though the mechanism of spread is uncertain, the transmission of this disease is occurring during the asymptomatic incubation period of about 12-14 days [13].

2. Epidemiology:

Globally as of 21st April 2020, there are about 213 Countries, areas or territories which are affected, with 2,397,216 confirmed cases including 162,956 deaths [14]. The top most affected countries are as listed in Table 1. Whereas in India there are about 20,004 confirmed cases including 15,462 actives, 3,901 recovered and 641 deceased [15].

3. Evolution

Coronaviruses belong to the family Coronaviridae in the order Nidovirales and are classified into four genera: Alphacoronavirus, Beta corona virus, Gamma corona virus, and Delta corona virus. It's discovered that there are various wildlife-borne CoVs in different regions of the world, however it has also been indicated that bats are the main and original natural reservoirs of Alphacoronavirus and Betacoronavirus because of its special metabolic and immune systems which helps them to tolerate diverse viruses [16]. Although 17 years have passed without a recurrence of the SARS outbreak, recently in the year 2019, Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was found to be

Table 1: Highest cases by Country, Territory, or Area as of 21st April 2020 as per WHO report

Country, Territory, or Area	Confirmed Cases	Deaths
United States of America	751,273	35,884
Spain	200,210	20,852
Italy	181,228	24,114
Germany	143,457	4,598
United Kingdom	124,747	16,509
France	113,513	20,233
Turkey	90,980	2,140
China	84,250	4,642
Iran	83,505	5,209
Russian Federation	52,763	
Belgium	39,983	5,828
Brazil	38,654	2,462

responsible for the infection of 2,397,216 patients in 213 countries/regions across the globe, which is having a CoV of Rhinolophus bat origin with 98.7% nucleotide similarity, to the partial RNA-dependent RNA polymerase (RdRp) gene of the bat coronavirus strain BtCoV/4991 (GenBank KP876546, 370 bp sequence of RdRp) and 87.9% nucleotide similarity to bat coronavirus strain bat-SL-CoVZC45 and bat-SL-CoVZXC21 [16]. Based on the genomic evidence and the presence of some bats and live animals in the seafood market in Wuhan, it's suspected that SARS-CoV-2 would have originated from bats or bat droppings associated with contaminated materials in the market or surrounding region. Therefore, from the evolutionary studies it has been identified that the SARS-CoV-2 is a novel coronavirus which was introduced independently from animals to humans.

4. Modes of transmission of disease

COVID-19 is caused by a corona virus called SARS-COV-2. Corona viruses are a large family of viruses that are common in people and many different species of animals, including camels, cattle, cats and bats. Rarely, animal corona viruses can infect people and then spread between people. This occurred with MERS-COV and SARS-COV, and now with the virus that causes COVID-19 [18].

Studies suggest that the virus is mainly transmitted through contact with respiratory droplets rather than through the air. People catch the virus from others who have the virus. The disease can spread through small droplets from the nose or mouth from person to person when a person with COVID-19 coughs or exhales. These droplets land on objects and surfaces, other people then catch the virus by touching these objects or surfaces, later touching their eyes, nose or mouth. People can also catch COVID-19 if they breathe in droplets from a person with COVID-19 who coughs out or exhales droplets [19].

The risk of catching COVID-19 from the feces of an infected person is low. While the initial investigations suggest that the virus may be present in feces in some cases. Spread through this route is not a main feature of the outbreak. WHO is assessing ongoing research on ways the COVID-19 is spread [18].

People may acquire the corona virus through air and also after touching the contaminated objects. Recent research has suggested the COVID-19 virus can survive for a long time on various types of surface. Research has shown viable virus detected on hands, fabric, metal surface, cardboard, copper, aerosols, plastic and stainless steel. From many studies it is concluded that this virus can survive from some hour to some days and it also depends on atmosphere humidity and temperature as well.

Table 2: life span of virus on specific surfaces

Surfaces	Lifespan of virus	Reference
Hands	10 minutes	[19-20]
Fabric	9 Hours	
Metal Surface	12 Hours	
Cardboard	24 Hours	
Copper	4 Hours	
Aerosols	3 Hours	
Plastic & Stainless Steels	72 Days	

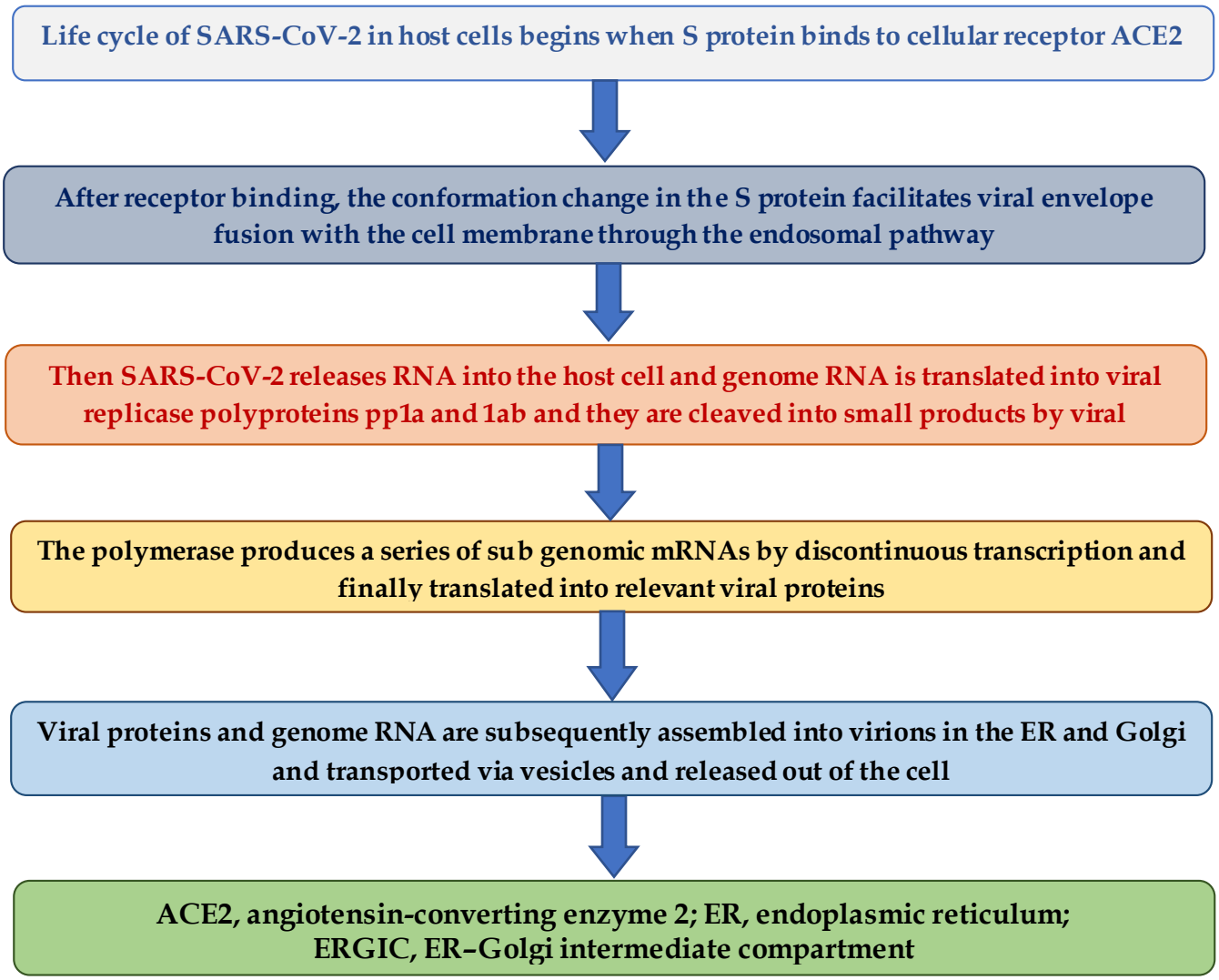
5. Manifestation of infection

Incubation period means the time between catching the virus and beginning to have symptoms of the disease. The estimate of the incubation period for COVID-19 ranges from 1-14 days. Most commonly around 5-6 days [22].

All corona viruses contain specific genes in ORF1 downstream regions that encode proteins for viral replication, nucleo capsid and spikes formation [22]. The glycoprotein spikes on the outer surface of corona viruses are responsible for the attachment and entry of the virus to host cells. The receptor-binding domain (RBD) is loosely attached among virus, therefore, the virus may infect multiple hosts [23-24]. Other corona

viruses mostly recognize amino peptidases or carbohydrates as a key receptor for entry to human cells while SARS-CoV and MERS-CoV recognize exopeptidase [25]. The entry mechanism of a corona virus depends upon cellular proteases which include, human airway trypsin-like protease (HAT), cathepsins and transmembrane protease serine 2 (TMPRSS2) that split the spike protein and establish further penetration changes. MERS-corona virus employs dipeptidyl peptidase 4 (DPP4), while HCoV-NL63 and SARS-corona virus require angiotensin-converting enzyme 2 (ACE2) as a key receptor [28].

SARS-CoV-2 possesses the typical coronavirus structure with spike protein and also expressed other polyproteins, nucleoproteins, and membrane proteins, such as RNA polymerase, 3-chymotrypsin-like protease, papain-like protease, helicase, glycoprotein, and accessory proteins [28-30]. The spike protein of SARS-CoV-2 contains a 3-D structure in the RBD region to maintain the van der Waals forces [32]. The 394 glutamine residue in the RBD region of SARS-CoV-2 is recognized by the critical lysine 31 residue on the human ACE2 receptor [33-34].



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6. Diagnosis

The symptoms of the SARS-CoV-2 infection at early stages of disease are non-specific. and hence cannot be used for diagnosis. The COVID-19 patients found to have symptoms such as fever, sore throat, cough, fatigue, sputum production and shortness of breath; most of these could be associated with other respiratory infections [35]. At present, the most common methods used by global healthcare system for diagnosis of COVID-19 are Nucleic acid testing, and antibody testing. Medical imaging can be used in severe cases.

6.1 Nucleic acid testing

This method involves diagnosis is by specific molecular tests on respiratory samples (throat swab/ nasopharyngeal swab/ sputum/ endotracheal aspirates and bronchoalveolar lavage [36]. PCR testing is a primary method of diagnosing SARS-CoV-2. PCR testing detects the genetic information of the virus, the RNA. This method is used to detect the presence of an antigen. The most commonly used method for detecting COVID-19 is real-time RT-PCR (RdRp gene) assay based on oral swabs [35]. The method involves reverse transcription of SARS-CoV-2 RNA into complementary DNA followed by amplification of cDNA. A number of reverse transcription polymerase chain reaction (RT-PCR) based diagnostic kits have been designed for the detection of SARS-CoV-2.

As the molecular techniques can target and identify specific pathogen these methods are more suitable. The PCR tests are very labour intensive, with several stages at which errors may occur between sampling and analysis. There are chances of False negatives can occur up to 30% of the time.

6.2 Serological testing

An antibody test help to determine the proportion of the population has been infected. CDC has developed a new laboratory test to determine how much of the U.S. population has been exposed to SARS-CoV-2. The serology test indicates the presence of antibodies, which are specific proteins made in response to infections. Those who are tested after infection will have antibodies in their blood and in other tissues. The presence of antibodies by this test indicate that a person had an immune response to SARS-CoV-2**.** Antibody test results are important in detecting infections with few or no symptoms and it allows us to estimate how many people have been infected nationally. But this method is not suitable to find out who has infected because the antibodies are generated after a week or two, after which time the virus may not be present in the system [37].

6.3 Computed tomography

In severe cases chest CT scans are used as a clinical diagnosis for COVID19. In this method cross-sectional images are produced by taking many X-ray measurements at different angles across the patient's chest. The images are analyzed by radiologists to find out abnormal features. The method is non-invasive.

The chest X-ray (CXR) usually shows bilateral infiltrates which may be normal in early disease. The CT is more sensitive and specific. It is also abnormal in asymptomatic patients. In fact, abnormal CT scans have been used to diagnose (SARS-CoV-2 in suspect cases with negative molecular diagnosis; many of these patients had positive molecular tests on repeat testing [38].

7. Treatment

Currently there is no specific antiviral treatment is approved for COVID-19. And also, there is no vaccine available for SARS-CoV-2. Infected patients should receive supportive care to relieve symptoms. In severe cases vital organ function should be supported. No vaccine is currently available for SARS-CoV-2. Adequate isolation is preliminary requisite to prevent transmission of disease in case of COVID. Maintaining hydration and nutrition and controlling fever and cough also essential. Provision of oxygen through nasal

prongs and non-invasive ventilation is recommended for hypoxic patients [39].

Based on the experience with SARS and MERS; antiviral drugs such as ribavirin, lopinavir ritonavir have been used. But the studies are still going on this regard [39]. Lopinavir/ritonavir, a protease inhibitor broadly available for treating HIV infection has been recommended by the Chinese authorities to treat COVID-19. A recent randomized trial of 14 days of lopinavir/ritonavir therapy among severely ill patients hospitalized with COVID-19 showed no clinical improvement and no reduction in SARS-CoV-2 viral load beyond standard care. Despite these negative results, lopinavir/ritonavir is still commonly used to treat COVID often concomitantly with hydroxychloroquine or chloroquine [41].

After several clinical trials Hydroxychloroquine and chloroquine have considered as potential therapeutic agents against COVID-19. While there is a growing body of scientific data, there is also concern for harm, particularly for cardiac arrhythmias [42]. These drugs considered to be worthy for clinical trials as they have minimal risk upon use, a long experience of use in other diseases, cost effectiveness and easy availability across India. A significant mortality has been shown in a subgroup with COVID-19 and Diabetes. Since HCQ has approved for treatment of diabetes in India it can be employed in case of diabetes and COVID-19.

Experimental studies have suggested chloroquine as a promising anti-malarial drug and has the capability of inhibiting the replication of several intracellular micro-organisms including SARS-CoV-2 [5].

From recent surveys most of physicians considered that hydroxychloroquine (HCQ) and azithromycin are the two most effective drugs against COVID-19.

The new study which was performed at IHU Mediterranee infection, Marseille, France included treatment of 1061 COVID-19 patients, with Hydroxychloroquine-Azithromycin (HCQ-AZ) combination for atleast three days and a follow-up investigation of at least 9 days. A good clinical outcome with virological cure was observed in 973 patients(91.7%) as well as there was no cardiac toxicity. But 4.3%, ie.,46 patients observed to be showing poor outcome with 5 death, 10 were transferred into intensive care units and 31 required 10 days of hospitalization. Hence from this study HCQ-AZ combination soon after diagnosis, is found to be safe and effective treatment for COVID-19 patients with a mortality rate of 0.5% in elderly patients.

8. Prevention

Since there is no approved drug for Covid-19 prevention is crucial. namely, non-specific features of the disease, the chances of infection even before onset of symptoms in the incubation period, transmission from asymptomatic people, long incubation period, prolonged duration of the illness are some of the factors which made the disease more dangerous. Isolation of confirmed or suspected patients are recommended. Health care workers should be provided with suitable safety devices to avoid transmission as they are in high risk.

At the community level, people should maintain social distancing in crowded areas and avoid non-essential travel to places with ongoing transmission.

Cleaning hands often, covering nose and mouth with mask while coughing and sneezing, seeking immediate medical attention if unwell lastly but not the least following health authority guidelines are important preventive measures of COVID-19.

9. Conclusion

The rate of spreading of SARS COV 2 is found to be drastically increasing day by day leading to death of elderly people & immune compromised individuals. Even though some treatment protocol has bought positive impact in recovering the patient it is better to stay safe by taking need full precautionary measure.

Conflicts of interest: The authors stated that no conflicts of interest.

References

1. www.niaid.nih.gov/diseases-conditions/coronaviruses
2. Tang JW *et al.* Emergence of a novel coron virus causing respiratory illness from Wuhan, China. *Journal of Infection,* 2020; 80: 350–371, *doi: https://doi.org/10.1016/j.jinf.2020.01.014*
3. Chatterjee P, *et al.* The 2019 novel coronavirus disease (COVID-19) pandemic: A review of the current evidence. *Indian J Med Res*, Epub ahead of print. 2020, *doi: 10.4103/ijmr.IJMR_519_20*
4. Gorbalenya AE, *et al.* Severe acute respiratory syndrome-related coronavirus: The species and its viruses - A statement of the Coronavirus Study Group. bioRxiv 2020. *doi: https://doi. org/10.1101/2020.02.07.937862*.
5. Kagne SR. New Coronavirus: Death warrant in China, Int. Res. Journal of Science & Engineering, 2020, Volume 8 Issue 1: 1-4
6. Woo PC, Huang Y, Lau SK, Yuen KY. Coronavirus genomics and bioinformatics analysis. *Viruses* 2010; 2:1804-20. *doi: 10.3390/v2081803*
7. Gennaro FD, *et al.* (2020). Coronavirus Diseases (COVID-19) Current Status and Future Perspectives: A Narrative Review. *Int. J. Environ. Res. Public Health* 2020, 17, 2690; *doi:10.3390/ijerph17082690*
8. Wang LS, *et al.* A review of the 2019 Novel Coronavirus (COVID-19) based on current evidence, International *Journal of Antimicrobial Agents* (2020), *doi: https://doi.org/10.1016/j.ijantimicag.2020.105948*
9. Sahin AR, *et al.* Novel Coronavirus (COVID-19) Outbreak: A Review of the Current Literature. *EJMO* 2020;4(1):1–7. *doi: 10.14744/ejmo.2020.12220*
10. Ahmed SS. The Coronavirus Disease 2019 (COVID-19): A Review. JAMMR, 2020, 32(4): 1-9, 2020; *doi: 10.9734/JAMMR/2020/v32i430393*
11. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen.
12. Jamwal A, Bhatnagar S, Sharma P. Coronavirus Disease 2019 (COVID-19): Current Literature and Status in India. Preprints 2020, 2020040189. *doi: 10.20944/preprints202004.0189.v1).*
13. Sohrabi C *et al.* World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). *Int J Surg.*, 2020 Apr; 76:71-76. *doi: 10.1016/j.ijsu.2020.02.034.*
14. https://covid19.who.int/
15. https://www.covid19india.org/
16. Han Y *et al.* Identification of Diverse Bat Alphacoronaviruses and Betacoronaviruses in China Provides New Insights into the Evolution and Origin of Coronavirus-Related Diseases. *Front. Microbiol.* 2019 10:1900. *doi: 10.3389/fmicb.2019.01900*
17. Lai CC, Shih TP and Ko WC *et al.* Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. *International Journal of Antimicrobial Agents* 2020, 55 105924. *doi: https://doi.org/10.1016/j.ijantimicag.2020.105924*
18. https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/summary.html#emergence
19. https://www.who.int/news-room/q-a-detail/q-a-coronaviruses
20. Van Doremalen N, Bushmaker T, Morris DH, Holbrook, MG, Gamble A, Williamson BN and Lloyd-Smith JO. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1", *New England Journal of Medicine*, 2020.
21. Mark DeBeliso, Joseph M. Berning, Carole Carson, Trish Sevene, Chad Harris, Kent J. Adams, Joe Walsh, Mike Climstein,"COVID-19: Beyond Washing Your Hands and Social Distancing", *International Journal of Science and Engineering Investigations, 2020,* vol. 9, issue 99, ISSN: 2251-8843, April 2020 Received on April 4 2020.
22. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200402-sitrep-73-covid-19.pdf?sfvrsn=5ae25bc7_2
23. van S, Boheemen M de Graaf, C Lauber Bestebroer TM, Raj VS, Zaki AM *et al.* "Genomic characterization of a newly discovered coronavirus associated with acute respiratory distress syndrome in humans", *MBio*, 3 (6), pp. e00473-e512, (2012).
24. Raj VS, Mou H, Smits SL, Dekkers DH, Müller MA, Dijkman R *et al.* Dipeptidyl peptidase 4 is a functional receptor for the emerging human coronavirus-EMC", *Nature*, 495 (7440), pp. 251-254, (2013).
25. Perlman S, Netland J. Coronaviruses post-SARS: update on replication and pathogenesis, Nat Rev Microbiol, 2009, 7 (6): 439-450.
26. Wang N, Shi X, Jiang L, Zhang S, Wang D, Tong P *et al.* Structure of MERS-CoV spike receptor-binding domain complexed with human receptor DPP4, *Cell Res*, 2013, 23 (8): 986.
27. Glowacka I, Bertram S, Müller MA, Allen P, Soilleux E, Pfefferle S *et al.* Evidence that TMPRSS2 activates the severe acute respiratory syndrome coronavirus spike protein for membrane fusion and reduces viral control by

the humoral immune response", *J Virol*., 2011, 85 (9) pp. 4122-4134.

28. Bertram S, Glowacka I, Müller MA, Lavender H, Gnirss K, Nehlmeier I *et al.* Cleavage and activation of the severe acute respiratory syndrome coronavirus spike protein by human airway trypsin-like protease", *J Virol*., 2011, 85 (24), pp. 13363-13372.

29. Wu F, Zhao S, Yu B, Chen YM, Wang W, Song ZG, *et al.* A new coronavirus associated with human respiratory disease in China", *Nature*, 2020, 1–5.

30. Zhou P, Yang X, Wang X, Hu B, Zhang L, Zhang W, *et al.* A pneumonia outbreak associated with a new coronavirus of probable bat origin", *Nature* [Internet]., p. 3, Feb (2020).

31. Xu X, Chen P, Wang J, Feng J, Zhou H, Li X *et al.* Evolution of the novel corona virus from the ongoing Wuhan outbreak and modeling of its spike protein for risk of human transmission", *Science China Life Sciences,* 2020, 63 (3), pp. 457-460.

32. Wan Y, Shang J, Graham R, Baric RS, Li F. Receptor recognition by novel corona virus from Wuhan: an analysis based on decade-long structural studies of SARS", *J Virol*. 2020.

33. Muhammad Adnan Shereen, Suliman Khan, Naidia Bashir, Rabeea Siddique, "COVID-19 infection: Origin, transmission, and characteristics of human corona viruses", *Journal of Advanced Research*, 2020,Volume 24, Pages 91-98, July 2020.

34. Cascella M, Rajnik M, Cuomo A, Dulebohn SC, Di Napoli R. Features, evaluation and treatment coronavirus (COVID-19). In *StatPearls [Internet]*. StatPearls Publishing, 2020.

35. Udugama B, Kadhiresan P, Kozlowski HN, Malekjahani A, Osborne M, Li VY *et al.* Diagnosing COVID-19: The Disease and Tools for Detection. *ACS nano*., 2020.

36. Singhal T. A review of coronavirus disease-2019 (COVID-19). *The Indian Journal of Pediatrics*, 2020, 1-6.

37. Chloe Kent. Different paths to the same destination: screening for Covid-19. Verdict medical devices, 2020.

38. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020; 395:507–13.

39. Pastick KA, Okafor EC, Wang F, Lofgren SM, Skipper CP, Nicol MR, *et al.* Hydroxychloroquine and Chloroquine for Treatment of SARS-CoV-2 (COVID-19). In *Open Forum Infectious Diseases,* 2020.

40. Singh AK, Singh A, Shaikh A, Singh R and Misra A. Chloroquine and hydroxychloroquine in the treatment of COVID-19 with or without diabetes: a systematic search and a narrative review with a special reference to India and other developing countries. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews,* 2020.

41. Cortegiani A, Ingoglia G, Ippolito M, Giarratano A and Einav S. A systematic review on the efficacy and safety of chloroquine for the treatment of COVID-19. *Journal of critical care,* 2020.

42. Rithu BS. SARS COV 2 Identity matrix, *Int. Res. Journal of Science & Engineering*, 2020. Volume 8 (2) : 41-57.