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Covid-19 pandemic outbreak: challenges and remedies

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ABSTRACT
The rise in the appearance of zoonotic contagious diseases for example SARS, MERS, and Ebola, in the last two decades poses a severe threat to community health globally. From the time when the epidemic of the severe acute respiratory syndrome (SARS) in 2002, people have faced three beta coronaviruses (CoV) dependent zoonotic outbreaks, SARS-CoV (2002–2003), MERS-CoV (2012), and the recent one SARS-CoV-2 in late 2019., The number of testified Covid-19 cases have crossed three million cases till date, since the first patient was hospitalized on 12 December 2019. This article reviewed the SARS CoV-2 origin, structure, reservoir, transmission, and the efforts done so far to control this pandemic. As of now, there is no available antiviral drug or vaccine against COVID-19 but the efforts are being done by pharmaceuticals companies and research institutes at the global level to develop drugs and vaccines against this pandemic. Some reported success in earlier trials seems like a silver lining in this dark.
Keywords*: Coronavirus, Zoonotic, SARS-CoV, SARS-CoV-2, MERS-CoV, COVID-19.*

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INTRODUCTION

As per the studies reported, the emergence of viral epidemics like Middle East respiratory syndrome coronavirus (MERS-CoV), Severe Acute Respiratory Syndrome coronavirus (SARS-CoV), H1N1 influenza, Ebola, Zika have challenged the developments done by the human being in last few decades whether in the field of economics, science, technology or health and raise a question of survival against such epidemics. The recent name which joins this group is SARS-CoV-2, the causative agent for the current pandemic, named "COVID-19," the abbreviation of "coronavirus disease 2019". A comparative mortality rate of recent epidemics is shown in table 1. The International Committee on Taxonomy of Viruses (ICTV) named it as the SARS-CoV-2 virus instead of its earlier name 2019-nCov because of having similar characteristics such as the virus that caused the SARS outbreak (SARS-CoVs) in 2002 [1]. With its rapid outbreak, coronavirus appeared as resonant of epidemics reported in the recent past, like SARS, MERS, swine flu, and the Zika virus [2].

Table 1. Mortality rates of recent epidemics.

Disease	Cases	Estimated Mortality Rate
COVID19 (as of April. 30 2020)	3,275,475	3.4%
MERS (as of Jan, 2020)	2,519	34.3 %
SARS (as of Jul, 2003)	8,098	9.6 %
H1N1 (SWINE FLU) (Apr, 2009 – Aug 2010)	700M-1.4B (est.)	0.02 %

Data adapted from World Health Organisation archive

After its first appearance in late 2019 in Wuhan (China) the cases of COVID-19 has been reported all across the globe, and later it leads to the current COVID-19 pandemic [3, 4]. At the ground of symptoms appearance SARS (2002-03) virus-infected people displayed severe symptoms almost just

after the infection but in contrast, the recent SARS-CoV-2 infected persons have the potential to spread the virus without showing any symptoms or even at the beginning of the sickness. As per the findings of recent research printed in *Nature,* the patients spread virus most proficiently in the first week of their exposure to the infection, when the appearance of symptoms in them is minor [5]. As per the report of USCDCP (United States Centers for Disease Control and Prevention), 25% of infected people have not shown any symptoms. On 30th January 2020, the World Health Organization (WHO) acknowledged this COVID-19 outbreaks of SARS CoV-2 as a Public Health Emergency of International Concern (PHEIC) and later, on 11th March 2020 as a pandemic [6]. Local viral transmissions have been reported in a number of countries across all six WHO regions. As of 30th April 2020, the number of worldwide reported cases was 3,275,475 resulting in a hike in the death toll to 231,576 deaths. More than 1,031,782 people have been recovered so far [7, 8].

Taxonomy

SARS-CoV-2 is a member of the Coronaviridae family with a positive, single-stranded RNA (+ ss RNA) as its genetic material [9]. The presence of coronavirus reported in a wide range of organisms from mammals to birds [10]. The classification of coronavirus is described in table 2.

Table 2. Classification of coronaviruses.

Group 1	Group 2	Group 3
Human coronavirus (HCoV) 229E	Human coronavirus (HCoV) OC43	Avian infectious bronchitis virus (IBV)
Human coronavirus NL63	Human coronavirus HKU1	Turkey coronavirus (TcoV)
Porcine transmissible gastro-enteritis virus (TGEV)	SARS coronavirus	
Canine coronavirus (CCoV)	Rat coronavirus (RCoV)	
Feline infectious peritonitis virus (FIPV)	Rat sialodacro-adenitis virus (SDAV)	
Porcine epidemic diarrhoea virus (PEDV)	Mouse hepatitis viru (MHV)	
Bat coronaviruses (e.g. 1A, HKU2)	Bovine coronavirus (BCoV)	
	Porcine haemagglutinating encephalomyelitis virus (HEV)	
	Bat coronaviruses (e.g. SARS-like coronavirus Rp3, HKU4, 229E like bat coronavirus	

Reservoir

There is a strong perception that the SARS-CoV-2 has a zoonotic origin because of its proximity to Bat coronavirus [11]. There were only two human coronaviruses (HCoVs) that were identified to cause minor infections like common cold till the SARS (2002-03) epidemic erupt in China. These HCoVs have been got attention only after the outbreaks of MERS and SARS and it was being noticed that how severe and life-threatening the coronavirus infection could be. With the outbreaks of recent COVID-19 pandemic, the coronavirus again comes in the spotlight. The available researches have track down the origin of SARS-CoV, MERS-CoV, and SARS-CoV-2 from a bat and suggested that they are being transmitted to humans via an intermediate host [12]. After the identification of civets and dromedary camels as the intermediate host for SARS-CoV and MERS-CoV respectively, different approaches have been applied to target these viruses in these intermediate hosts have achieved a great success to curb these pandemics. After the identification of numerous pedigrees of pangolin beta-CoVs with its close relation to SARS-CoV-2, efforts are being done to break this transmission chain to end this epidemic [13].

Structural components

As per the literature, available coronavirus particles (SARS-CoV-2) are the sphere in shape with a diameter of around 125nm (60-140nm).

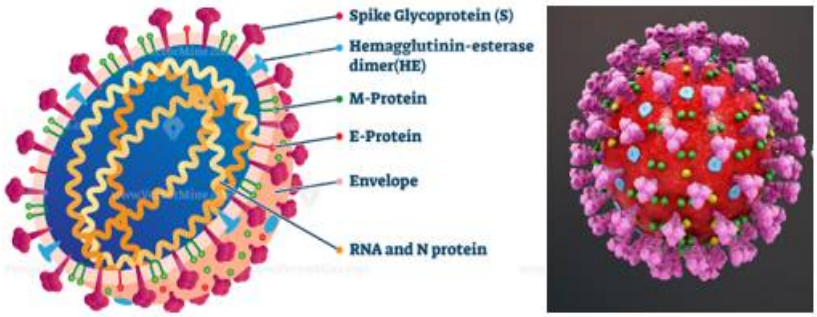

Fig 1. Structure of SARS-CoV

SARS-CoV-2 have an approx. 29 kb long positive single-stranded RNA as the genetic material which encodes 29 proteins, out of these only four S (spike), E (envelope), M (membrane), and N (nucleocapsid) are structural proteins as shown in figure 1 [14]. These spikes (S) proteins are responsible for the naming of coronavirus, as the term corona means crown and these spike proteins provide a crown shape to the coronavirus [15]. Figure 2 gives a detailed overview of these proteins. The invasion of host cells can be possible only because of these spike proteins, as they help the virus in its binding to host cell receptors called angiotensin-converting enzyme 2 (ACE2) [16]. While the amino acid sequences of these spike proteins in SARS (2002-03) and SARS-CoV-2 have shown almost 80 percent similarity but the affinity of these spike proteins for host ACE2 receptor in SARS-CoV-2 is much stronger than the SARS (2002-03). This strong binding of spike protein to host ACE2 makes the SARS-CoV-2 more virulent than the other members of its family.

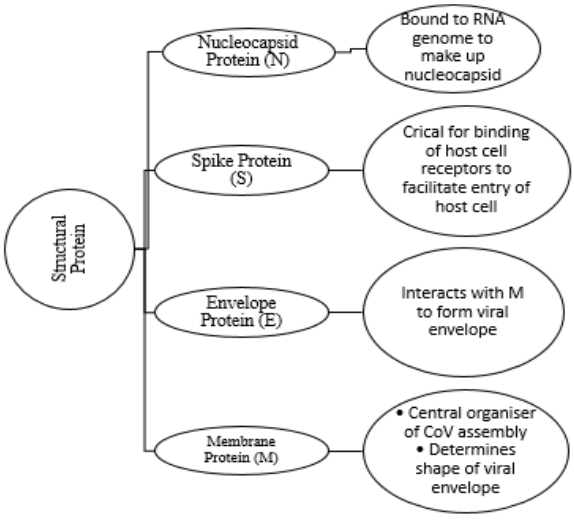

Fig 2. Structural Proteins and the roles played in SARS-CoV-2

Besides these four structural proteins, there are 25 other proteins are present in the coronavirus and they are called Non-Structural proteins (NS proteins). These NS proteins are translated in the form of polypeptides and cleaved by proteases in later stages to make it functional. These NS proteins play an important role in the virus assembly and to evade the host immune system against these viruses [17].

Test/ Diagnosis

The real-time assay uses the TaqMan fluorogenic probe-based chemistry that uses the 5´ nuclease activity of TaqDNA polymerase and enables the detection of a specific PCR product as it accumulates during PCR cycles. Coronaviruses under the subgenus Sarbeco virus that includes 2019-nCoV, SARS-CoV, and bat SARS-like coronaviruses were used to generate a non-redundant alignment. Three assays based on their matching to the Wuhan virus as per inspection of the sequence alignment were designed.

Treatment

As of now, there is no antiviral drug or vaccine for the treatment of COVID-19 has been approved so the treatment in current situations should be supportive and symptomatic which include adequate isolation for the prevention of transmission to other persons whether they arecontacts, patients, security personal, healthcare workers and social workers. Some antiviral drugs such as Ribavirin, Lopinavirritonavir, Remdesivir, and chloroquine have been used based on the experience with other related viral diseases

like SARS, MERS, and HIV [18]. This COVID-19 pandemic has rapidly catalyzed the development of novel coronavirus vaccines across the world. Some of the major coronavirus drugs that are developing by the pharmaceutical companies across the world and showing potential to become major coronavirus vaccines or antivirals against COVID-19 infection or are in different stages of trials have been included in the table given below.

Table 3. List of major coronavirus drugs that pharmaceutical companies and research institutes across the world are developing.

Hydroxychloroquine/Plaquenil	Got approval to be tested as a treatment for COVID-19 from USFDA.
Favilavir	Approved by National Medical Products Administration of China, as a treatment for coronavirus.
Fusogenix DNA vaccine (Entos Pharmaceuticals)	Entos is working on developing a proteo-lipid vehicle containing multiple protein epitopes derived from SARS-COV-2 proteins, which leads to the stimulation of an immune response in the body against COVID-19 infection.
ChAdOx1 nCoV-19	an adenovirus vaccine vector developed by the Oxford university's Jenner Institute
Gimsilumab	Roivant Sciences is advancing a clinical-stage, human monoclonal antibody
AdCOVID	Altimmune has collaborated with the University of Alabama at Birmingham (UAB) to develop a single dose intranasal vaccine for COVID-19
TJM2	I-MabBiopharma is developing a neutralising antibody, as a treatment for cytokine storm in patients suffering from a severe case of coronavirus infection.
TZLS-501	Tiziana Life Sciences is developing is a human anti-interleukin-6 receptor (IL-6R), which helps in preventing lung damage and elevated levels of IL-6.

CONCLUSION

COVID-19 pandemic has raised a heap of challenges to the world, not at the level of medical and public health infrastructure but the economic front also. As the world facing the rapid arrival of zoonotic diseases, it is very likely to see a rise in the emergence of zoonotic viruses and pathogens in the future. So it is a need of time that the efforts should be done not only to curb the current outbreak but to develop preventive strategies to avoid or face the outbreaks of any pandemic with zoonotic origin in the future.

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REFERENCES

1. Cascella, M., Rajnik, M., Cuomo, A., Dulebohn, S. C., & Di Napoli, R. (2020). Features, evaluation and treatment coronavirus (COVID-19). In *Statpearls [internet]*. StatPearls Publishing.
2. https://www.businessinsider.in/international/news/how-the-coronavirus-compares-to-sars-swine-flu-zika-and other epidemics /article show/74560116. cms?utm_ source=content of interest &utm_medium=text&utm_ campaign=cppst].
3. Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y., ... & Xing, X. (2020). Early transmission dynamics in Wuhan, China, of novel coronavirus–infected pneumonia. *New England Journal of Medicine*.
4. Guan, W. J., Ni, Z. Y., Hu, Y., Liang, W. H., Ou, C. Q., He, J. X., ... & Du, B. (2020). Clinical characteristics of 2019 novel coronavirus infection in China. *MedRxiv.*
5. Wölfel, R., Corman, V. M., Guggemos, W., Seilmaier, M., Zange, S., Müller, M. A., ... & Hoelscher, M. (2020). Virological assessment of hospitalized patients with COVID-2019. *Nature*, 1-10.
6. Middle East Respiratory Syndrome Coronavirus. Available at: https://www.who.int/emergencies/mers-cov/en/. Accessed 16 Feb 2020.

7. https://www.worldometers.info/coronavirus/coronavirus-death-rate/
8. World Health Organization. Situation reports. Available at: https:// www.who.int/emergencies/diseases/novel-coronavirus-2019/ situation-reports/. Accessed 22 Feb 2020.
9. Su, S., Wong, G., Shi, W., Liu, J., Lai, A. C., Zhou, J., ... & Gao, G. F. (2016). Epidemiology, genetic recombination, and pathogenesis of coronaviruses. *Trends in microbiology*, *24*(6): 490-502.
10. Li, F. (2012). Evidence for a common evolutionary origin of coronavirus spike protein receptor-binding subunits. *Journal of virology*, *86*(5): 2856-2858.
11. Ye, Z. W., Yuan, S., Yuen, K. S., Fung, S. Y., Chan, C. P., &Jin, D. Y. (2020). Zoonotic origins of human coronaviruses. *International Journal of Biological Sciences*, *16*(10): 1686.
12. Guan, Y., Zheng, B. J., He, Y. Q., Liu, X. L., Zhuang, Z. X., Cheung, C. L., ... & Butt, K. M. (2003). Isolation and characterization of viruses related to the SARS coronavirus from animals in southern China. *Science*, *302*(5643): 276-278.
13. Lam, T. T. Y., Shum, M. H. H., Zhu, H. C., Tong, Y. G., Ni, X. B., Liao, Y. S., ... & Leung, G. M. (2020). Identifying SARS-CoV-2 related coronaviruses in Malayan pangolins. *Nature*, 1-6.
14. Schoeman, D., & Fielding, B. C. (2019). Coronavirus envelope protein: current knowledge. *Virology journal*, *16*(1): 69.
15. Du, L., He, Y., Zhou, Y., Liu, S., Zheng, B. J., & Jiang, S. (2009). The spike protein of SARS-CoV—a target for vaccine and therapeutic development. *Nature Reviews Microbiology*, *7*(3): 226-236.
16. Wan, Y., Shang, J., Graham, R., Baric, R. S., & Li, F. (2020). Receptor recognition by the novel coronavirus from Wuhan: an analysis based on decade-long structural studies of SARS coronavirus. *Journal of virology*, *94*(7).
17. Wu, F., Zhao, S., Yu, B., Chen, Y. M., Wang, W., Song, Z. G., ... & Yuan, M. L. (2020). A new coronavirus associated with human respiratory disease in China. *Nature*, *579*(7798): 265-269.
18. Wang, M., Cao, R., Zhang, L., Yang, X., Liu, J., Xu, M., Shi, Z., Hu, Z., Zhong, W., & Xiao, G. (2020). Remdesivir and chloroquine effectively inhibit the recently emerged novel coronavirus (2019-nCoV) in vitro. *Cell research*, *30*(3): 269-271.

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