



Research Article

COVID-19 STRUCTURE OF VIRUS, PROGRESSION OF DISEASE & PRESENT STATUS: A REVIEW.

Ajaz Ahmed Wani*, Muneesh Kumar and Imteyaz Ahmed

Department of Zoology Govt. Degree College Doda, University of Jammu, Jammu, India

ARTICLE INFO

Article History:

Received 6th February, 2020

Received in revised form 15th March, 2020

Accepted 12th April, 2020

Published online 28th May, 2020

Key words:

COVID-19, SARS, Status, India, World, Pandemic.

ABSTRACT

Viruses are the microorganisms responsible for different types of severe diseases in human beings and other animals. During the last decades the transmissions of these microorganisms from animals to the human beings have been identified as a cause of large scale disease outbreak, such as Severe Acute Respiratory Syndrome (SARS) and Middle east Respiratory syndrome etc cause worldwide pandemic that claimed thousand of human lives, whereas SARS causes great damage in Swin industry in 2017. All these have a common characteristic as they are highly pathogenic to human and Livestock. But in December 2019 a new strain of Coronavirus originated in Wuhan City of China, within a short period engulfed the whole world and leads to the death of lakhs of people and millions of infection worldwide leading to the complete lockdown of the world. The purpose of this review article is to summarize the current knowledge of COVID-19 and geographical distribution and present status of this highly contagious disease potential.

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INTRODUCTION

The viral disease i.e. Covid-19 is highly contagious diseases caused by the severe acute respiratory syndrome coronavirus (SARS Cov-2). The disease was first reported in Dec-2019 in Wuhan City of the capital of China's Hubei province and then spread globally in pandemic commonly called is Covid-19 pandemic. On 31st December 2019, a cluster of cases of pneumonia of unknown cases in the city of Wuhan, Hubei province in China was reported to the World Health Organisation. In January 2020, a previously unknown new virus was identified (WHO) subsequently named the 2019 novel coronavirius, (Covid-19) and sample obtained from cases and analysis of virus genetic material indicated that this was the cause of the outbreak. This novel Corona virus was named diseases 2019 (Covid-19) by WHO in Feb-2020, and the virus is referred to as SARAS- COV-2 and the associated disease is COVID-19 (WHO).

The World Health Organisation (WHO) has declared the coronavirus disease 2019 (COVID-19) a pandemic. Corona Virus comprises of a large family of viruses that infect human being and other animals such as Bats, Cats, Cattles, Pangolins etc. Seven different strains have been reported or identified and are as under:

1. 229 E (Alpha Coronaviurs)
2. OC43 (Beta Coronaviurs)
3. NL63 (Alpha Coronaviurs)

4. MERS-COV (The Beta Coronaviurs that causes Middle East Respiratory Syndrome (MERS.))
5. HKUI (Beta Coronaviurs)
6. SARS-COV (The Beta Coronaviurs that causes SevereAcute Respiratory Syndrome or SARS).
7. SARS-COV-2 (The novel Coronaviurs that causes Coronaviurs disease 2019, or COVID-19).

Sometime such viruses got transmitted from animals to human beings (Zoonatic transmission) and then spread further via human to human. The virus that causes (Covid-19) is designated as Severe Acute Respiratory Syndrome Crona Virus 2 (SARS-COV-2) aslo called as COVID-19. Coronaviruses were first identified by a group of Virologist (JD Almeida, DM Berry, CH Cunningham, D Hamre, MS Hofstad, L Mallucci K McIntosh and DAJ Tyrrel who relayed their findings in 1971 to the Journal Nature. The word "Corona" has many different meanings but it was the sun that the Virologists had in mind when they chose the name Coronaviruses. They compare the fringes of projections on the outside of the virus with the solar corona.

Structure

The coronaviruses is large family of single stranded RNA viruses (ssRNA), isolated from different animal species. It is reported to be a new member of a beta coronavirus genus and is closely related to several acute respiratory syndrome coronavirus (SARAS-COV) and to several bat coronaviruses. The understanding of the genetic and phenotypic structure of COVID-19 in pathogenesis is important for the production of drugs and vaccine.

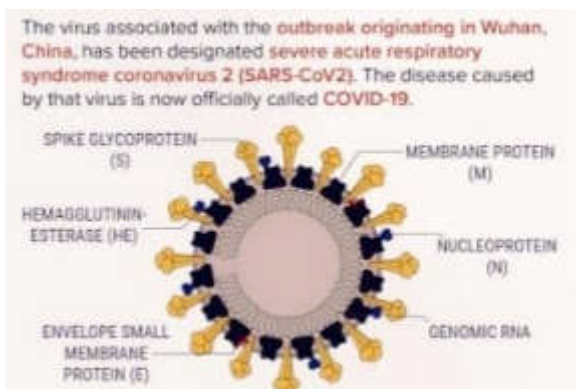
*Corresponding author: **Ajaz Ahmed Wani**

Department of Zoology Govt. Degree College Doda, University of Jammu, Jammu, India

COVID -19 is a spherical and pleomorphic enveloped particle containing single stranded RNA associated with nucleoprotein within a capsid comprised of matrix protein and diameter of virus is about 120nm. The envelope bears club shaped glycoproteins projections. Some coronaviruses also contain a hem agglutinin esterase protein (HE) (de Haan Kuol, *et al* 1998). These viruses are susceptible to mutation and recombination and are therefore highly diverse.

Coronaviruses possess the largest genomes (26.4-31.7 kb) among all known RNA viruses, with G+C contents varying from 32 % to 43%. The viral genome contains distinctive features including unique N-terminal fragments within the spike proteins. Genes for the major structural protein in all coronaviruses occur in the 5'-3' order as S,E, M and N⁵ (Woo, PCX Haung Yet *et al* 2010).

The corona-like appearance of Coronavirus is due to so called spike glycoproteins which are necessary for the viruses to enter the host cells. The spike has two sub units, One sub unit S1 binds to a receptor on the surface of the host cell, the other subunit S2 fuses with cell membrane. The cell membrane receptor for both SARS COV-1 and SARS-COV-2 is a form of angiotensin converting enzyme ACE-2 different from the enzyme that is inhibited by conventional ACE-1 inhibitors such as enalapril and ranipril. Briefly the S1 subunit of the spike binds to the ACE-2 enzyme on the cell membrane surface. On getting deposited in the nasal and pharyngeal mucus membrane, the virus starts proliferating rapidly and causes COVID-19. The lymphocytes are highly vulnerable to this virus and hence lymphocytopenia is a common feature.



Ultra Structure of Coronavirus

Progression of Diseases.

The progression of diseases can be divided into three distinct phases

1. Early infection phase.
2. Pulmonary Phase.
3. Severe hyper inflammatory Phase.

During the early infection phase the initial inflammatory response may cause local symptoms like throat irritation and dry cough and symptoms like fever, myalgia and headaches. Many patients may be asymptomatic. During this phase the patient is infective and can transmit the disease to a large number of people. It has been observed that a large number of patients may not progress beyond this phase and recover slowly over a period of 2-6 weeks.

During the pulmonary phase the virus infiltrates the lung parenchyma and begins to proliferate. This state is

characterized by injury to lung parenchyma leading to vaso dilation, increased endothelial permeability and leucocytes recruitment and as a result leading to further pulmonary damage, hypoxemia and cardiovascular stress.

In a subset of patients, the host inflammatory response continues to amplify and results in systemic inflammation. This often labeled as cytokine storm, can injure distant organs. The protagonist of this storm is interleukin 6 (IL-6), which is produced by activated leukocytes and acts on a large number of cells and tissues. It is able to promote the differentiation of B lymphocytes, promotes the growth of some categories of cells and inhibits the growth of others. This hyperinflammatory response can be confirmed by increased ferritin levels, interleukins and C-reactive proteins in the serum.

In a critical patient, two types of respiratory failure are recognized. One is ARDS or a type H patient that is characterized by high elastance, high risk to left heart, high lung weight and high recruitability. Few cases reports of biopsy of involved lung showed bilateral diffuse alveolar damage with cellular fibromyoid exudates desquamation of pneumocytes and hyaline membrane formation typical of ARDS (Zhexu, *et al* 2020). These patients may need intubation and benefit from mechanical ventilation with high PEEP.

Another sub group of patient have been labeled as type L Phenotypes with lungs having low elastance, low ventilation perfusion ratio, low Lung weight and low recruitability. These patients are often severely hypoxic without significant dyspnoea, some have compared this to high altitude mountain sickness kind of presentation. These patients may respond to oxygen therapy alone and may not benefit from high pressure ventilation. Although the prominent site of infection and hence inflammation is lungs, the amplified inflammatory response can have deleterious effects on other organ including heart.

There are some evidences of direct myocardial injury as well. Autopsies have confirmed mononuclear infiltrate with necrosis thus satisfying criteria for viral myocarditis (Yao X H *et al* 2020). The other organs which get affected are kidneys in case of serious illness, especially ARDS and COVID-19 is no exception. A retrospective study of 201 patients with confirmed COVID-19 pneumonia in China shows that 4.5% developed acute kidney injury Wu, C. *et al* 2020. The cytokine storm alone cannot explain AKI and only small percentage of ARDS patient developed AKI. Fluid dysregulation sepsis, rhabdomyolysis, and cardiac failure can all contribute to AKI.

Status

Beginning from Wuhan China, slowly and steadily this deadly infection of COVID-19 swelled to cover almost whole of the planet. As on 03 May 2020, WHO reports that there are 33,56,205 confirmed COVID-19 cases across the globe and 2,37,034 people have lost their lives. In the days and weeks ahead, we expect to see the number of cases, number of deaths and the number of affected countries climbs even higher. Covid-19 has been characterised as pandemic. Word pandemic can't be taken lightly and carelessly. It is a word that, if misused, can cause unreasonable fear or unjustified acceptance that the fight is over, leading to unnecessary suffering and death. The table below shows how the number of COVID-19 positive cases and deaths have surged alarmingly

through these months, thus making it clear that the problem of this infection has multiplied at an unexpected rate.

S.No.	Date	No. of confirmed COVID-19 cases globally	No. of COVID-19 deaths globally
1	31-01-2020	9847	213
2	29-02-2020	85951	2941
3	31-03-2020	754933	36522
4	03-05-2020	3356205	237034

Table showing the number of COVID-19 positive cases and deaths at the end of different months

Global comparison of number of COVID-19 in different WHO regions of the world shows that at the beginning of May 2020, Europe is topping the list followed by Americans. Africa is having least number of cases. Abrupt increase in the number of cases in America happened in the month of March 2020.

Table showing the cumulative number of COVID-19 cases in different WHO regions at the end of different months and in the beginning of May (WHO 3rd May 2020)

S.No.	WHO Regions	Confirmed Cases Globally			
		31-01-2020	29-02-2020	31-03-2020	04-05-2020
1	Europe	09	329	31131	12518895
2	Americas	02	01	20929	1433756
3	East Mediterranean	00	218	3986	206004
4	West Pacific	1995	1278	867	152773
5	South East Asia	05	01	427	65071
6	Africa	00	00	303	30536

Problem of Covid-19 is alarming, affecting almost every occupied region of the world. It is not just a public health crisis; it is the crisis that hasn't left any sector of life untouched. Our India is also one of the severely affected countries of the world but fortunately it has not been in the list of top 12 affected countries. Country wide lockdown had been extended till May 3. At present, at the end of lockdown, as per Ministry of Home Affairs and Family Welfare, there are 28,046 active cases of COVID-19 with 10,632 number of cured case. Total deaths on May 3 2020 are 1301. There has been a continuous increasing trend in the total number of COVID-19 cases across India. State of Maharashtra has been at the top of the list till date with 12296 number of confirmed COVID-19 cases and 521 deaths. Graphs below show the increasing trend in the number of COVID-19 cases in India and in the state of Maharashtra. In India the maximum affected area has been around central India and then towards south. The North Eastern sister states show least affect. The following table shows the state wise list of COVID-19 cases in India on May 3 2020.

S. No.	Name of State / UT	Total Confirmed cases (Including 111 foreign Nationals)	Cured/Discharged/ Migrated	Death
1	Andaman and Nicobar Islands	33	16	0
2	Andhra Pradesh	1525	441	33
3	Arunachal Pradesh	1	1	0
4	Assam	43	32	1
5	Bihar	481	107	4
6	Chandigarh	88	17	0
7	Chhattisgarh	43	36	0
8	Delhi	4122	1256	64
9	Goa	7	7	0
10	Gujarat	5054	896	262
11	Haryana	360	227	4
12	Himachal Pradesh	40	33	1
13	Jammu and Kashmir	666	254	8

14	Jharkhand	115	22	3
15	Karnataka	601	271	25
16	Kerala	499	400	4
17	Ladakh	22	17	0
18	Madhya Pradesh	2846	624	151
19	Maharashtra	12296	2000	521
20	Manipur	2	2	0
21	Meghalaya	12	0	1
22	Mizoram	1	0	0
23	Odisha	157	56	1
24	Puducherry	8	5	0
25	Punjab	772	112	20
26	Rajasthan	2770	1121	65
27	Tamil Nadu	2757	1341	29
28	Telangana	1063	458	28
29	Tripura	4	2	0
30	Uttarakhand	59	39	0
31	Uttar Pradesh	2487	689	43
32	West Bengal	922	151	33
Total number of confirmed cases in India		39980*	10633	1301

*124 cases are being assigned to states for contact tracing

Table showing the state/UT wise distribution of Infected, Cured and deaths as a result of COVID-19 on 03-05-2020 (Source: MoHFW)

The states like Mizoram, Manipur and Arunachal Pradesh etc. are having the no. cases of COVID-19 below 5. The UT of J&K is at the 12th position in the number of COVID-19 cases. A total 666 positive cases have been reported here till May 3. The table below shows the district wise breakdown in the number of COVID-19 positive cases in J&K. The district of Bandipora tops the list with 128 numbers of positive cases as on 03 May 2020. Comparatively region of Kashmir leads in the number of positive case than Jammu.

S. No.	District	District wise Positive cases as on 04-05-2020					
		No. of Positive Cases		Active Positive	Recovered		Deaths
		Reported Today	Cumulative upto 4th May 2020		Recovered Today	Recovered upto 4th May 2020	
1	Bandipora	2	130	68	6	61	1
2	Anantnag	0	109	107	0	1	1
3	Srinagar	3	109	32	5	75	2
4	Baramulla	12	103	61	5	39	3
5	Shopian	2	83	64	0	19	0
6	Kupwara	0	66	43	0	23	0
7	Budgam	4	30	18	0	12	0
8	Ganderbal	0	14	0	0	14	0
9	Kulgam	0	11	8	0	3	0
10	Pulwama	1	9	6	0	3	0
11	Jammu	1	27	1	0	26	0
12	Udhampur	0	20	0	0	19	1
13	Samba	0	7	3	0	4	0
14	Rajouri	0	4	1	0	3	0
15	Kathua	0	1	1	0	0	0
16	Kishtwar	0	1	0	0	1	0
17	Ramban	0	1	1	0	0	0
18	Reasi	0	1	1	0	0	0
Total		25	726	415	16	303	8

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How to cite this article:

Ajaz Ahmed Wani, Muneesh Kumar and Imteyaz Ahmed (2020) ' Covid-19 Structure of Virus, Progression of Disease & Present Status: a Review.', *International Journal of Current Advanced Research*, 09(05), pp. 22040-22043. DOI: <http://dx.doi.org/10.24327/ijcar.2020.22043.4343>
