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Corona Virus and COVID-19

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***Abstract*: Corona virus disease COVID-19 is an infectious disease caused by a virus called as severe acute respiratory syndrome coronavirus 2 (SARS CoV-2). COVID-19 has now become pandemic.**

***Keywords*: Corona virus, COVID-19, Epidemic, Endemic, Pandemic.**

1. Introduction

A virus is the causative agent that can replicate inside of the living cell of an organism. It has ability to infect plants, animals and even micro-organisms. The branch of microbiology which deals with study of viruses is called as virology [1]. Epidemiology is analysis of patterns of diseases in defined population [2]. Endemic infection means an infection which is constantly maintained at particular level without effects of external factors. Example chickenpox is endemic in UK [3]. Epidemic infection is an infection which can spread rapidly in the population within a very less period of time. Example Meningococcal infection [4]. Pandemic is an endemic of infectious disease which can spread in multiple area or worldwide affecting a very large population. Example COVID-19 & AIDS [5]. It's very much fatal in nature. Viruses are classified in various classes according to various systems of classification which includes The International Committee on Taxonomy of Viruses (ICTV) [6] and Baltimore classification system [7], [8]. David Baltimore is a Noble prize winning Biologist introduced a Baltimore system of virus classification and is widely adopted by virology. It is based on mechanism of production of mRNA by viruses. According to Baltimore, viruses can be classified in seven groups as class I: dsDNAviruses (e.g. Adenoviruses, Herpesviruses, Poxviruses), class II: ssDNA viruses (+ strand or "sense") DNA (e.g. Parvoviruses), Class III: dsRNA viruses (e.g. Reoviruses), class IV: (+) ssRNA viruses (+ strand or sense) RNA, e.g. Coronaviruses, Picornaviruses, Togaviruses), class V: (−)ssRNA viruses (− strand or antisense) RNA, (e.g. Orthomyxoviruses, Rhabdoviruses), class VI: ssRNA-RT viruses (+ strand or sense) RNA with DNA intermediate in life-cycle (e.g. Retroviruses), class VII: dsDNA-RT viruses DNA with RNA intermediate in life-cycle (e.g. Hepadnaviruses**).**

Corona virus is a single stranded RNA virus. In Wuhan, Hubei province, China, first strain of corona virus was found in end of December 2019 and is resulted in pandemic [9]. But the first case of COVID-19 was confirmed on 17 November 2019 [10]. On Jan 11, 2020, China announced first death due to COVID-19.

The person was of 61 years old and had purchased goods from sea food market [11]. As of now more than 200 countries and territories have been affected by COVID-19 with major outbreaks occurring in central China, Iran, Western Europe, and United States. As of 25 June 2020, more than 9.39 million cases of COVID-19 and 481000 death have been reported across 188 countries and territories [12]. More than 4.71 million people have been recovered from COVID-19 [13]

Origin of corona viruses: Bats are the major natural reservoir of human coronaviruses [14]. MERS-CoV introduced in humans from bats through camels [15]. SARS-CoV introduced in humans from horseshoe bats through leaf nose bats [16]. Bovine coronaviruses are originated from rodents and not from bats [17]. Murine coronavirus had originated from mouse [14].

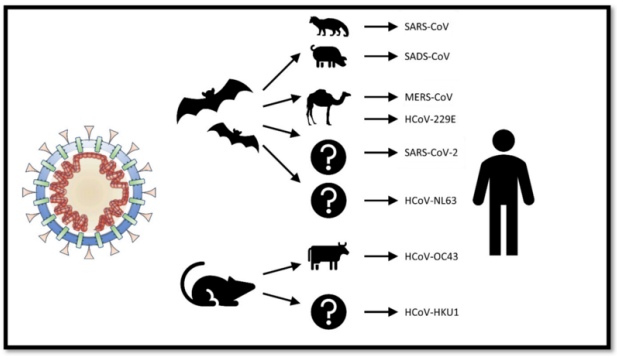

Fig. 1. Origin of coronaviruses

Types of coronaviruses: Total seven species of human coronaviruses are known. Out of that four produce mild and two produce severe symptoms [18].

Human coronaviruses producing mild symptoms are

1. Human coronavirus OC43
2. Human coronavirus HKU1

3. Human coronavirus 229E
4. Human coronavirus NL63

Human coronaviruses producing severe symptoms are

1. Middle East Respiratory Syndrome coronavirus (MERS CoV)
2. Severe Acute Respiratory Syndrome coronavirus (SARS-CoV)
3. Severe Acute Respiratory Syndrome coronavirus (SARS-CoV2)

Characteristics of symptoms produced by severe coronaviruses [19]

	MERS CoV	SARS-CoV	SARS-CoV2
Fever	98%	99–100%	87.9%
Dry cough	47%	29–75%	67.7%
Dyspnea	72%	40–42%	18.6%
Diarrhea	26%	20–25%	3.7%
Sore throat	21%	13–25%	13.9%

Etymology of coronavirus: Corona is a Latin word meaning "crown" from which name of corona virus as it has proteinous crown like projections on its outer surface [20]. June Almeida and David Tyrell was the first virologist who introduced the name corona virus [21], [22].

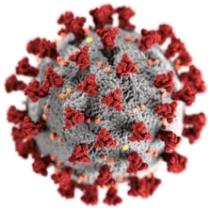

Fig. 2. Outer view of corona virus

Virology of corona virus: Corona virus can be killed outside of the animal body by use of soap, which burst the protective lipid layer of outer coat [23]. SARS CoV-2 has similar structure as that of original SARS CoV [24]. It is also from zoonotic origin. Genetic analysis study showed that corona viruses belongs to subfamily Orthocoronaviridae, family Coronaviridae, order Nidovirales, realm Riboviria, genus Betacoronavirus and subgenus Sarbecovirus [25]. Structure of corona virus: Corona viruses are rough spherical particle having larger size with proteinous projections / spikes on outer surface [26]. The diameter for virus ranges from 125-130 nm. The length of spike measures about 20 nm and diameter of sphere measures about 80 nm [27].

The viral envelope is made of lipid bilayer which contains membrane, envelope and spike structures proteins in a ration of 1:20:300. The approximate number of spikes present are 74 [28].

The corona virus spikes has S1 and S2 protein subunits and has surface fusion properties which aids for receptor fusion and membrane binding within host cell and virus. S1 subunit is involved in formation of head of virus while S2 subunit is involved in formation of stem of the spike. Head of the spike has receptor binding domain while stem of the spike helps to anchor the spike in viral envelope firmly [27]. Nucleocapsid is present inside of the envelope which is composed of multiple copies of N-protein which bound to single stranded RNA genome [29].

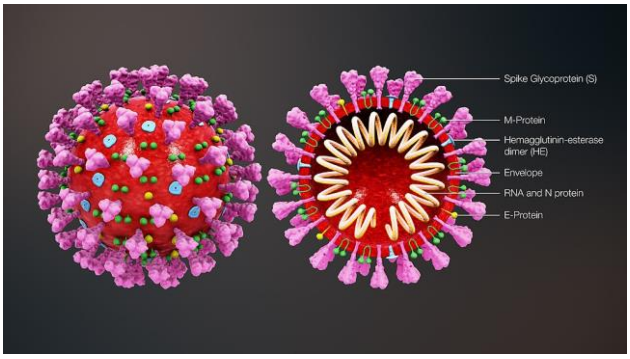

Fig. 3. Cross section of corona virus

Pathophysiology: COVID-19 mostly affect lungs because virus enters host cells through angiotensin converting enzyme 2 (ACE 2) which is mostly present in type II alveolar cells of lungs in dense amount. This virus has spikes made of glycoproteins on its outer surface, which easily binds with ACE 2 and enters host cell. The amount of ACE 2 in each tissue is directly proportional to the severity of the disease in that tissue. Hence weaker activity of ACE 2 is suggested to be protective for COVID 19 [30]. If ACE 2 activity is more, ACE 2 blocking medicines are suggested for use [31]. As the replication of corona virus increases in alveolar cell, the disease will progress which follows death due to respiratory failure.

Transmission: Infected person may spreads droplets through coughing, sneezing, talking or signing and these droplets may enter the non-infected person which is in close contact with infected person leading to corona virus infection [32]. That's why WHO launched 1 meter social distancing concept. The US CDC recommends for 2 meter distance [33] [34]. It has been reported that some persons are infected with corona virus can transmit the virus without showing symptoms. One study showed that 40 % of people remain asymptomatic even though they are infected with corona virus [35]. Person may remain infectious for fourteen days before appearance of symptoms (called pre-symptomatic transmission). Contaminated droplets may fall on the floors or surfaces and if non-infected person touches these surfaces and then to eyes, nose or mouth, then get infected from such droplets. Hence washing hands for at least 20 seconds every hour is very necessary. Corona virus remains infectious up to four hours on copper, on day on cardboard, three days on plastics and stainless steel [36]. If surfaces are disinfected, then chances of infections by corona virus van be reduces. But disinfectants can't be a treatment for COVID-19. Saliva and sputum carries large concentration of corona viruses, hence kissing, intimate contact, fecal-oral route can transmit the virus [37]. It could not be sexually transmitted [38]. Life cycle and replication of corona virus: Once the viral protein spike attaches to the host cell receptor, then virus enters into host cell and infection begins. After that, host cell protease enzyme

breakdowns and activates the spike protein. By the process of endocytosis, virus enters the cells of the host and direct fusion occurs [39]. After that transcription, translation and recombination occurs by usual way [40], [41].

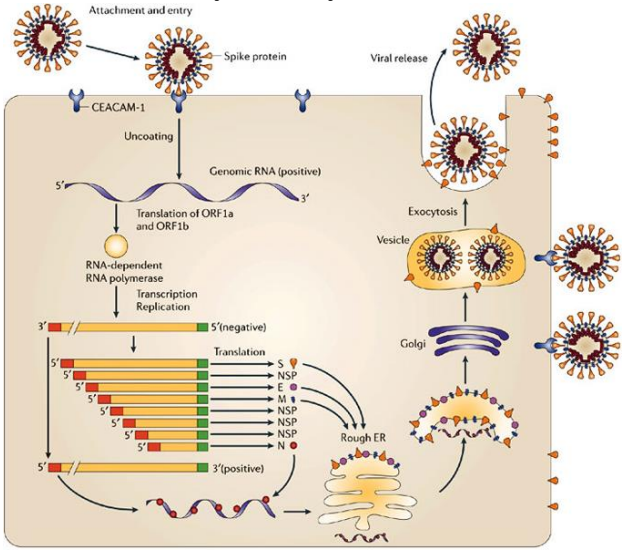

Fig. 4. Replication of corona virus

Signs and symptoms of COVID-19: The most common and important symptom of the COVID-19 is fever. But its severity shows variability. In some immunocompromised or weak healthy individual or in older person fever does not develop at all [42]. One study revealed that only 44 % people have fever. But absence of fever does not mean that person is free of corona infection [43]. Other important symptoms are dry cough and difficulty in breathing [44]. Common symptoms may include joint and muscle pain, sputum formation, fatigue, loss of appetite etc. Nausea, vomiting, and diarrhea and observed in varying percentage. Runny nose, sore throat, sneezing and skin rashes are less commonly observed symptoms [45]. Complications of COVID-19: Above symptoms may be converted to fatal health complications such as pneumonia, acute respiratory distress syndrome (ARDS), multi organ failure etc [46]. A study published in NJEM reveals that type A blood patients are more prone for COVID-19 infection than other blood types [47].

Diagnosis of COVID-19: Several testing protocols for COVID-19 are already published by WHO. Most widely accepted method of testing is rRT-PCR (real time reverse transcriptase polymerase chain reaction) [48]. Nasal swab or sputum can be used as a sample for testing [49]. Antibody test are in development [50].

Prevention of COVID-19: Govt. of India has launched a moto "Stay Home-Stay Safe" is the most acceptable one to avoid corona infection. Avoiding crowded places, social distancing, washing hands with soap frequently for 20 or more seconds, yoga and meditation, avoiding touching of unwashed hands to nose, mouth and eyes, using tissue while sneezing and coughing and disposing used tissue in covered dust bin, coughing and sneezing inside the elbow if tissue is not available, using mask to cover mouth and nose, using hand sanitizer etc [51].

Treatment and management: Currently only supportive care is available such as fluid therapy, oxygen support etc [52]. Immunity plays an important role for avoiding COVID-19. So personal hygiene, healthy lifestyles and best diet is recommended to improve immunity [53]. Recently, Glenmark Pharmaceuticals has launched Fabiflu tablets containing Favipiravir antiviral drug for the treatment of COVID-19. 1800 mg twice is to be administered on first day and for remaining 13 days, 800 mg twice daily has to be administered [54]. Patanjali also launched Divya Corona kit comprised of Coronil ayurvedic tablets, Shwasari vati and Molecular oil recently claiming that it will provide 100 % cure for COVID-19. AYUSH has approved Coronyl for treatment of COVID-19.

Major outbreaks due to COVID-19 [55]:

Country	Total cases	Death rate %	Recovery rate %
USA	2356715	5.19	41.6
Brazil	1086990	4.7	42.05
Russia	592280	1.39	58.15
India	426910	3.2	55.57
UK	304331	14	0
Spain	293352	9.65	0
Peru	254936	3.16	55.59
Chile	242355	1.85	82.76
Italy	238499	14.52	76.69
Iran	204952	4.7	79.81

2. Conclusion

This review concludes the important information about coronavirus and COVID-19. The information can spread awareness amongst professionals to avoid corona infection and COVID-19. Drugs used to treat COVID-19 have different properties and act differently in combating the COVID-19 viruses. No drug may be superior or inferior, however, the use of single drug may not be effective enough to control this deadly virus, so use of combination of antivirals with different mechanism of action may be more effective and at the same time their adverse events should not be underestimated. Immunity plays an important role in combating with COVID-19.

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