

Coronavirus - An Overview

Dr.Nandita Basak

Abstract: Coronavirus is a single stranded enveloped RNA virus having a nucleocapsid of helical symmetry. Due to the characteristic appearance of halo in the viron, it is known as corona. It is also the largest RNA virus. It is a zoonotic infection having flu like symptoms. There are three strains of coronavirus which produce potentially severe symptoms are-MERS-CoV, SARS CoV, SARS CoV2 or Novel coronavirus 2019. WHO has recently declared novel coronavirus 2019 also known as COVID19 as pandemic. This paper deals with COVID19, its symptoms, effects on human civilization, prevention and control. As no confirmed treatment is available at present, Social distancing is the best available measure to be strictly followed to contain it.

Keyword: Coronavirus, SARS CoV, SARS CoV2, MERS, COVID19, Super spreader, Social distancing, Treatment of coronavirus.

Date of Submission: 25-03-2020

Date of Acceptance: 14-04-2020

I. Introduction

In twenty-first century, science and technology have advanced a great deal, for luxury and comfort of human beings at the cost of our ecosystem. It resulted in drastic changes in our environment some being depletion of ice caps, decrease in the population of penguins, melting of snow in Greenland. These changes have caused different organisms to re-adapt themselves through mutation of genes. One of these mutations of genes in an organism has caused a disease which recently has become a pandemic to our society resulting in great loss of human life. Shutting down of business and locking oneself in house is the only way of prevention and control of the spread of the disease. This disease is caused by Corona virus.

Coronavirus constitutes the subfamily Orthocoronavirinae of Coronaviridae family and Nidovirales order. They are enveloped single stranded RNA virus having a nucleocapsid of helical symmetry, having a genome size between 26 to 32 kilo bases, making it largest for a RNA virus.

It is a zoonotic infection first discovered in 1960 causing bronchitis and common cold. They have animals as their primary host before they get transmitted to humans. Bats were the primer host during SARS-CoV, while in recent coronavirus (COVID-19) it is pangolin. Coronavirus are transmitted between humans by respiratory and fecal routes. WHO declared COVID 19 as pandemic.

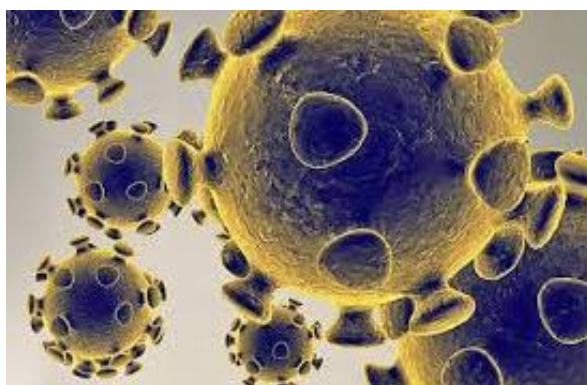


FIG 1: CORONAVIRUS THROUGH ELECTRON MICROSCOPE

II. Structure of Virus

Coronavirus sport a spiky projection on their outer surfaces resembling 'crown' like appearance in electron microscopic, giving the name corona, Latin derived from word crown. Beneath the coronavirus prolonged exterior lies a rounded core shrouded in protein and a "greasy membrane". core contains genetic

material that the virus can inject into vulnerable cells to infect them. The so called spike protein extended from within the core to the viral surface help to identify and latch to receptors.

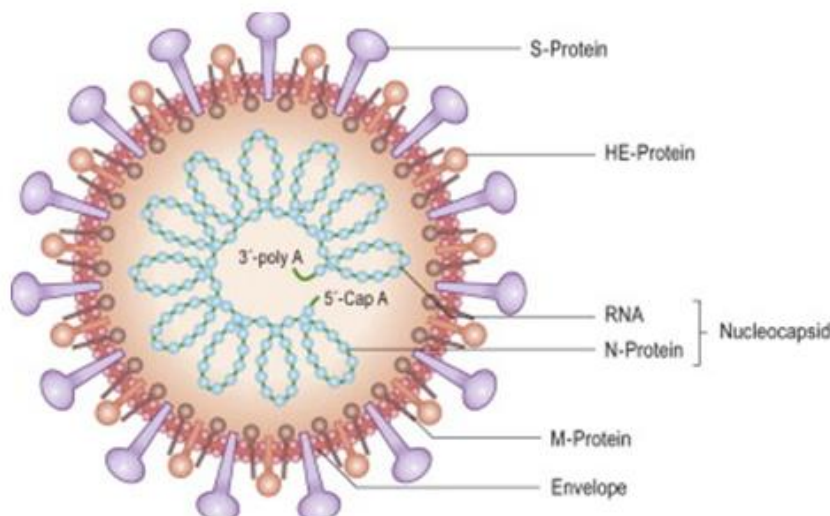


FIG 2: STRUCTURE OF THE VIRUS

Coronavirus genome has 5' methylated cap and 3' polyadenylated tail, which allows RNA to attack to the host cells ribosomes for translation. After entry into the host cells, the virus particle is uncoated and its genome enters the cell cytoplasm where it multiplies.

Common symptoms of Coronavirus are cough, sneezing, nausea, running nose, dizziness, diarrhea which later gets aggravated to respiratory distress resulting in pneumonia, bronchitis, multiple organ failure and even death.

Some infamous Coronavirus infection in past are SARS associated coronavirus also known as SARS-CoV was first reported in Guangdong- province, China in February 2013, having a global outbreak affecting 26 countries with over 8000 cases. Another infection is Middle East Respiratory Syndrome Coronavirus(MERS-CoV) which was first identified in Saudi Arabia in 2012, along with respiratory symptoms, it also had gastrointestinal symptoms like diarrhea .In this disease about 35% of reported cases had died.

The recent Coronavirus infection known as novel coronavirus or SARS-CoV 2 or COVID19 was first seen in December 2019 in Wuhan city of Huben Province in China. Since then it has been exploded world-wide with more than 19.2 lakhs infected cases and about 1 lakh deaths worldwide. COVID 19 has incubation period of 14 days and has an attack rate of 30-40% with a motility rate of 2%.

III. Effects in the Body

Coronavirus affects the body due to severe cytokine storm, an overreaction of bodies immune system , which is considered as the major factor behind the catastrophic organ failure even death. Let us look into the effects of how the virus invades system of our body.

LUNGS :-

As discussed earlier the virus enters into our body through respiratory route as droplets. Its effects are seen in 3 phases.

Phase1-The virus destroys the cilia cells which get sloughed and fills patient airway with debris and fluid, developing in both lungs accompanied by symptoms like shortness of breath.

Phase 2-The immune system kicks in, aroused by the presence of a viral invader, flooding the lung with immune cells to clear away the damage and repair the lung tissue. Normally it is lightly regulated and confined to infected area only, but sometimes, the immune system gets out of control and it kills anything that is in its way including healthy tissue, resulting in getting more damaged by immune system.

Phase 3- The lung damage continues to build up which results in respiratory failure. Even if death does not occur, it leaves permanent lung damage, resulting punch hole in lungs giving them 'honeycomb appearance'. These holes created by immune response formed scar that protects and stiffens the lungs. Meanwhile the

inflammation also makes membrane permeable affecting the ability to oxygenate blood. In severe cases lungs gets drowned in its own immune system.

BLOOD -:

It also affects the other system of our body due to the hyperactive immune response as explained above. The ‘Cytokine storm’ creates inflammation that weakens the blood vessels in lungs causing fluid to seep through air sacs resulting in bleeding out of blood vessels.

These storm spills into circulating system and causes systemic issues across multiple organs and along with diminished capacity to pump oxygen to rest of the body causes multiple organ failure.

STOMACH -:

Though the recent coronavirus COVID 19 does not have many reported cases of gastrointestinal symptoms, yet research has detected the virus in stool samples but it had a major role during SARS and MERS outbreak as nearly 1/3rd of reported patient had diarrhea as the virus lines the GI tract and flourishes causing damage or leakage of fluid causing diarrhea.

LIVER -:

Once the virus gets into the blood stream, they can swim across to any body part. Liver, being a very vascular organ; the virus easily gets infested into it. Though liver has a great regenerating power, but with abnormal high level of enzymes in the blood, which being a common characteristic of a ‘cytokine storm’ causes great damage to liver which resulting in liver failure.

KIDNEY -:

Kidney tubule are the most affected by coronavirus as it causes inflammation of the tubules, affecting the filtration rate causing kidney injury. About 6% of SARS patient, Quarter portion of MERS patients suffer from acute kidney injury, though it is an unknown feature in COVID19 , but it has fatal effects.

AKI might be due to a diverse set of causes, including low blood pressure, sepsis, drugs, use of antibiotics, metabolic disturbance or being connected to ventilator which becomes severe with cytokine storm.

PREGNANCY -:

Transmission of any strains of coronavirus through mother to baby has not yet been reported.

IV. Spread of Disease

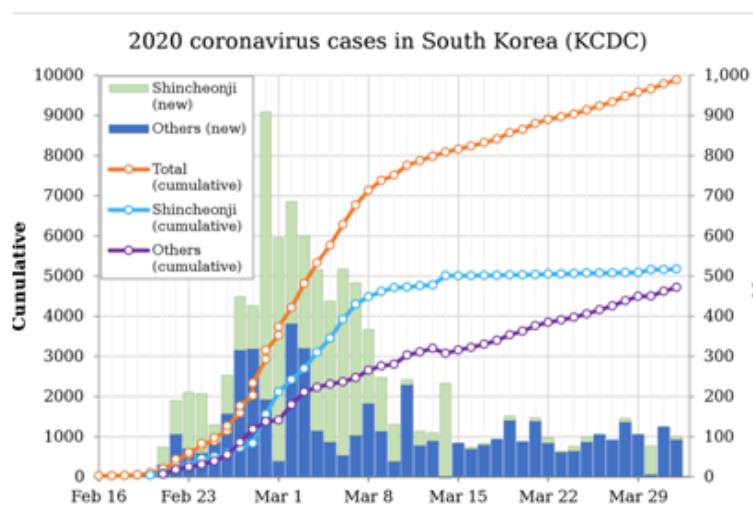


FIG 4: SPREAD OF DISEASE IN SOUTH KOREA

As discussed earlier the virus after getting mutated and transmitted to humans through animals , infects other humans through direct contract of aerosol, which further infects other human beings. As the disease has a incubation period of 14 days some asymptomatic persons become virus carriers and infect other people before

showing symptoms .these people are known as super spreader. Later due to high viral load in a community any person can get infected even without coming into direct contact.

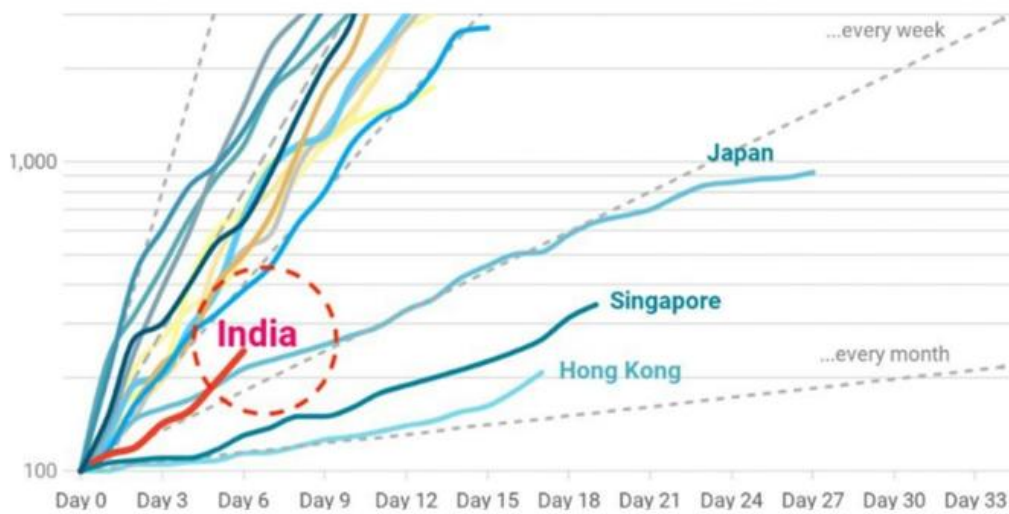


FIG 3: SPREAD OF DISEASE IN DIFFERENT COUNTRIES

Super spreader “a Case study of ‘patient 31’”

The government of South Korea was following conservative pattern of isolation and was able to contain the spread. A 60 years old female of Daegu also member of the Shincheonji religious organization on diagnosed with covid 19 infection was advised self quarantine. Though the patient was advised for self isolation, she continued to go to gatherings of Shincheonji also days after showing symptoms, which are typically held with people in very close proximity and include physical contact of the members. Resulting in many of the patient's close contacts turned out to be infected, triggering a drastic escalation of the South Korean spread of confirmed cases. Studies have showed she singly infected about 1160 patients and was named as super spreader.

Timespan of virus in different objects

The life span of Covid 19 virus in different surfaces is found as follows:

- Air- 3hrs
- Copper - 4hrs
- Cardboard 24 hrs
- Stainless steel - 2 to 3 days
- polypropylene plastic 3 days

V. Diagnosis-

Although for symptomatic patients the diagnosis is indicative than asymptomatic patients but in all cases confirmation of the disease done with diagnostic tests. A detailed list is noted below.

Types of samples taken for the confirmation of disease are

- Nasopharyngeal swab
- Sputum (if a person is coughing)
- Stool and urine
- Broncho alveolar lavage

TIMELINE OF COVID 19	
DAY 0	Patient gets infected
DAY 1-5	Onset of Symptoms
DAY 7	IgM positive (Day 7-21)
DAY 14	IgG positive
DAY 1 -28	SARS CoV2 RNA and antigen will be positive
DAY 21	IgM disappears
DAY 28	SARS CoV2 RNA and antigen disappears
DAY 0-5	ASYMPTOMATIC PHASE
DAY 0-7	WINDOW PERIOD (only PCR will be positive in this phase)
DAY14- 21	DECLINE PHASE (still infective)
DAY 21-28	CONVALESCENCE PHASE (still infected)

TABLE 1: TIMELINE OF COVID 19

Diagnostic Findings -:

BLOOD -

- Complete Blood Count - leukopenia and lymphoma
- Liver Function Test - Raised AST/ALT and total bilirubin.

Raised D dimer, CRP and LDH

- Raised Interleukin (IL6) and ferritin Levels
- Decreased Pro calcitonin levels
- PCT may be high with or without bacterial suspension

RADIOLOGY-

Chest Xray - Bilateral hazy peripheral opacity



FIG 5: CHEST XRAY

CT Thorax - Ground glass opacities
 Crazy paving appearance
 Air space opacity
 Broncho-vascular Thickening

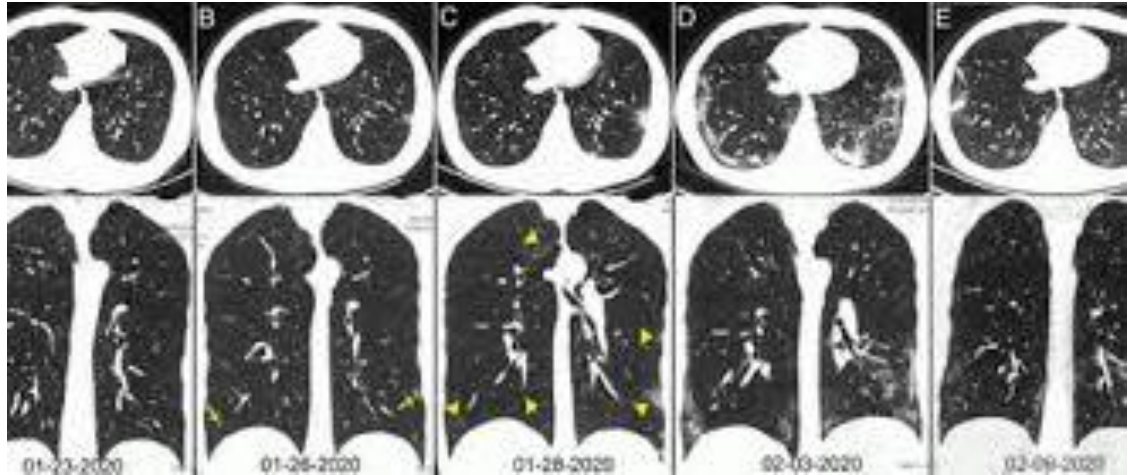


FIG 6: CT THORAX

Lung Ultrasound - Numerous B lines, ranging from focal to diffuse with spared area
 Irregular pleural line thickening
 Subpleural and Alveolar Consolidation with air bronchogenesis.
 Restitution of aeration during recovery i.e reappearance of bilateral A-lines

VI. Treatment

As presently there is no definite treatment or vaccine available for any strains of coronavirus. Only symptomatic treatments are available. At present there is about 293 clinical trials on various existing drugs on ability to fight off COVID19.

Research have shown the medicine for Ebola virus and plasma transfusion from persons who have been cured have shown effective result in decreasing the severity of the disease. Protease inhibitor class of drugs have shown in helping alert the immune system viral inhaler.

Tocilizumab drug which is an approved drug of Rheumatoid arthritis. It inhibits high Interleukin (IL-6) protein level that drive some inflammatory disease, resulting in decreasing the intensity of cytokine storm. Other experimental treatments for treatment for the disease includes drugs that reduce inflammation such as corticosteroid and baricitinib. Camostat mesylate drug used for pancreatitis, which inhibits a human protein involved with infection, antiviral have also seen some effects. US have entered into the first phase of clinical trial of vaccines. Recently a study in Monash University shown that an anti-parasitic drug 'Ivermectin' can kill Covid19 virus in lab

As there is no definite cure doctors are using mixture of different drugs.WHO have chosen a combination of remdesivir, lopinavir, ritonavir and chloroquine; a combination of antiviral, antimalarial and HIV drug with or without dexamethasone.

VII. Prevention

While all drugs are used in research basis and no confirm drugs is available till date. So the best available measure is prevention. Major guidelines for prevention are

- Maintaining Social Distancing

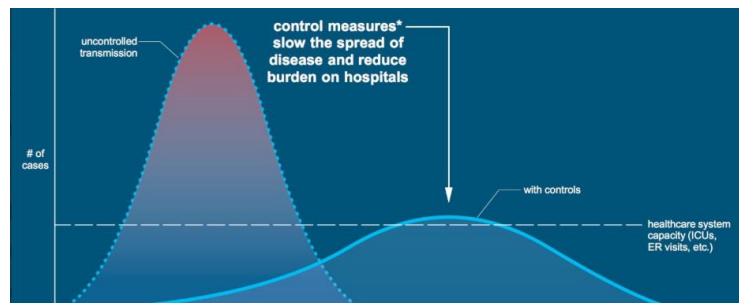


FIG 8: EFFECTS OF SOCIAL DISTANCING

- Avoid crowded areas
- Avoid overseas travelling
- Maintaining minimum 1 meter or 3 feet distance
- Information and self registration in government portal, who returned from overseas or hotspot areas.
- Repeated Sanitization of hand with soap or sanitizer
- Use of mask
- Use of tissue or covering with elbow while sneezing and coughing, with proper disposal of used tissue.

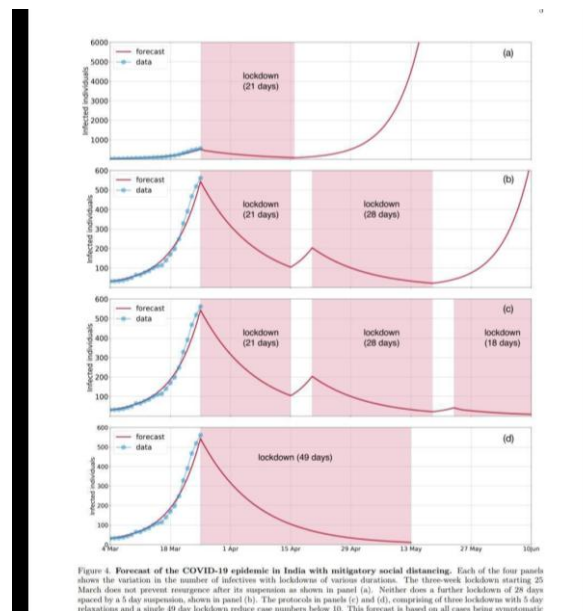


FIG 5: CONTROL OF DISEASE WITH SOCIAL DISTANCING

- Regular and frequent disinfection of places and surface with cleaning spray and disinfectants.
- Plenty of fluids to drink

Social distancing has been the greatest weapon for reducing the intensity of casualties; as well as reducing the burden on healthcare system, for the same reason many countries have kept themselves in total lockdown. Fig 5 shows four different variants of rise of number of cases in a region v/s duration of days same region is in lockdown. It also shows that a cumulative lock down of 49 days has greater effect than a number of different duration of lockdown.

VIII. Conclusion

The Recent strain of coronavirus or COVID 19 has caused a huge health related havoc for which WHO declared COVID 19 as a pandemic. The number of case worldwide is more than 19 lakhs and more than 1.2 lakh death due to it..

To overcome the present crisis the need of the hour is effective coordination between governments and its people with swift developments of drugs and vaccine to fight with it.

Reference

- [1]. "Virus Taxonomy ;2018 release" International Committee on Taxonomy of virus(ICTV) March 2019
- [2]. ICTV Taxonomy history: Orthocoronavirinae (ICTV)
- [3]. Kahn JS ,McIntosh K (Nov 2005) -"History and Recent advances in coronavirus discovery" The paediatric Infectious Journal
- [4]. Namendya Silva SA (march 2020) -Respiratory support for patient with COVID 19 infection
- [5]. McIntosh K(1974) ,Haas R Henle W, Hofschneider PH,Jerne NK -"Coronavirus :A comparative review-current topic in microbiology and immunology
- [6]. New SARS like virus found in found in middle east- Al Jazeera ;sep 2012 archived
- [7]. South Korea sudden spike of corona virus -Al Jazeera march 2020 archived
- [8]. MERS Transmission -CDC archived
- [9]. Covid-19 diagnostic testing - CDC archived 2020
- [10]. Novel coronavirus infection in wuhan China - CDC 2020 archived
- [11]. Emergency disease, novel coronavirus 2019 - WHO archive
- [12]. Solidarity Clinical trials for Covid 19 treatment, global researches on novel coronavirus -WHO march archived
- [13]. Current status of spread of virus - ministry of health and welfare.
- [14]. updates of Covid 19 in South Korea -KCDC
- [15]. Radio-graphical study of COVID19- Dr.Tristan Skalina, Dr.Daniel j Bell, et al

Dr.Nandita Basak." Coronavirus - An Overview." *IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)*, 15(2), (2020): pp. 30-37.