COVID-19 : Immunity Analysis and Precautions

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Abstract :- Corona virus disease has restricted all human activities and imposed Lockdown almost in every country of the world. COVID-19 is a kind of viral pneumonia which is caused by Severe Acute Respiratory Syndrome Corona virus 2 (SARS-CoV-2). The emergence of SARS-CoV-2 has been marked as the third introduction of a highly pathogenic corona virus into the human population after the Severe Acute Respiratory Syndrome Corona virus (SARS-CoV) novel corona virus and the Middle East Respiratory Syndrome Corona virus (MERS-CoV) in the twenty first century. the is capable of escaping innate immune responses, it can proliferate, unhindered, in primarily infected tissues. Subsequent cell death results in the release of virus particles and intracellular components to the extracellular space, which results in immune cell recruitment, the generation of immune complexes and associated damage. Immunity system needs strengthening to counter virus lateral infusion.

Symptoms of infection emerge during incubation period. Infection of monocytes /macrophages and/or recruitment of uninfected immune cells can result in massive inflammatory responses later in the disease. Uncontrolled production of pro-inflammatory mediators contributes to ARDS and cytokine storm syndrome. The major highlight corona virus infections led to the damage of lungs, while imbalance and excessive immune responses may cause pneumonia. Asymptomatic observation may be spreader.

In this mini review, a brief introduction of the general features, etymology, structure & mechanism of entrance of SARS-CoV-2 is discussed. Immunity in general and immune system along-with immunity boosters is studied. Current knowledge of prevention, diagnosis and treatment of covid-19 is shared. Till date less is revealed about corona virus. However, basic experience of SARS-CoV and MERS-CoV infections may be helpful in offering novel insight and potential therapeutic targets for combating the SARS-CoV-2 infection.

Keywords :- Corona virus, Pathogenesis, Diagnosis, Prevention, Treatment, Immunity, Immunity types, Hypersensitivity, Tolerance, Immunity boosters, Incubation period, Pandemic, Community spread, Quarantine, Isolation, Comorbidity, Syndrome, Social distancing,

Abbreviations :- COVID-19, WHO, SARS, MERS, SARS-CoV-2, SARS-CoV, MERS- CoV, CoV, 2019-nCoV, hCoV, ARDS, ARI, mAb, PPE, WBCs, IVCC, PHEIC, ICTV, ICD, HTK, RBD, FDA, RT-PCR, RCDT, ICMR, NIV, BBIL

Introduction :- Novel corona virus induced pneumonia was named as corona virus disease 2019 (COVID-19) by the World Health Organization (WHO) on February 11, 2020. Disease has rapidly increased in epidemic scale. Until the SARS outbreak in 2002 during which corona virus (CoV) showcased their potential for epidemic spread and significant pathogenicity in humans, they were mainly known as causes of mild respiratory and gastrointestinal disease. COVID-19 has been declared 'Pandemic' by WHO.

Over the last two decades, three novel beta-corona virus viz: SARS-CoV, MERS-CoV, SARS-CoV-2 have crossed the species barrier and caused significant outbreak characterized by high case fatality rates in humans. The latest addition to human pathogenic Corona viruses (hCoVs) is SARS-CoV-2, the cause of covid-19. The International Virus Classification Commission (IVCC) announced that the novel corona virus is named as SARS-CoV-2.

At present, the cases of covid-19 have been found in many countries around the world. At the time of submission of this review SARS-CoV-2 has infected over approximately 13 million people world wide and claimed 575K lives and threatening many more.

On the 31st of January 2020, the WHO announced that COVID-19 was listed as the Public Health Emergency of International Concern (PHEIC), meaning that it may pose risk to multiple countries and requires a coordinated international response. The pandemic virus has now spread to many countries and territories, while a lot is still unknown about the virus that cause covid-19. Currently, limited information is available to introduced the virus or on host factors affecting individual outcomes in covid-19.

Nomenclature and Etymology of COVID-19 :- The name corona virus is derived from Latin corona, meaning crown or wreath, itself a borrowing from Greek kopwvn krone, garland, wreath. The name human corona virus (hCoV) was designated by Ahmeida and Tyrell (virologists) in the year 1968.

The Viruses and the diseases have different names. Viruses are named based on their genetic structure to facilitate the development of diagnostic tests, vaccines and medicines. Virologists and the wider scientific community do this work, so viruses are named by the International Committee on Taxonomy of Viruses (ICTV). Diseases are named to enable discussion on disease prevention, spread, transmissibility, severity and treatment. Human disease preparedness and response is WHO's role, so diseases are officially named by WHO in the International Classification of Diseases (ICD). Here disease was named as COVID-19 or corona virus disease. Virus was named as SARS-CoV-2 or severe acute respiratory syndrome or corona virus. Virus is also recognized by Chinesevirus as named by American President Donald Trump. Some researchers named the virus as Wuhanvirus after the name of Wuhan city of Hubei province. WHO announced COVID-19 as the name of this new disease on 11 February 2020. ICTV announced SARS-CoV-2 as the name of the new virus on 11 February 2020. This name was chosen because the virus is genetically related to the corona virus responsible for the SARS outbreak of 2003. However the related two viruses are different.

COVID-19 :- Corona viruses belong to the Coronaviridae family in the Nidovirales order. Covid-19 is an infectious disease caused by a newly discovered corona virus or by a new strain of corona virus. Formerly, this disease was referred to as 2019 novel corona virus or 2019-n-CoV. Most people infected with the Covid-19 virus experience mild to moderate respiratory illness and recover without requiring special treatment. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease and cancer are more likely to develop serious illness.

The Covid-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes, so its important to practice respiratory etiquette. Covid-19 affects different people in different ways. Most infected people develop mild to moderate illness and recover without hospitalization. Generally it takes 5-6 days for infected person to develop symptoms.

Incubation period may be 14 depending on case history. Asymptomatic cases are also being reported nowadays.

Most Common Symptoms

- Fever
- Dry cough
- Tiredness

Less Common Symptoms

- Aches and pains
- Sore throat
- Diarrhoea
- Conjunctivitis
- Headache
- Loss of taste or smell
- A rash on skin, or decoloring of fingers or toes

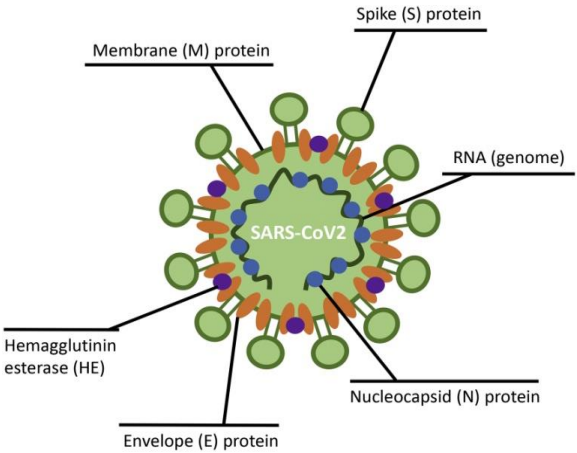
Serious Symptoms

- Difficult breathing or shortness of breath
- Chest pain
- Loss of speech
- Loss of movement

Structure of Corona Virus (Sars-Cov-2) :- CoVs are large enveloped viruses with a single stranded non segmented positive sense RNA genome that spans approximately 30 kb making it the largest known genome of any RNA virus. Being RNA viruses, CoVs readily evolve by mutation and homologous and non-homologous recombination, which expands their host range and facilitates crossing of species barriers. The diameter of genome is 85 nm.

Corona viruses are spherical in shape. Their are club-like projections on the virus surface which are referred to as spikes. Spikes may be 20 nm long. The virus membrane contains four structural components, the spike S, envelope E, membrane M and nucleocapsid N protein. For SARS-CoV and SARS-CoV-2, the S protein is the primary determinant for host tropism and pathogenicity. It is the main target for neutralizing antibodies and therefore of great interest in terms of immunological response and vaccine design. The spike structure is formed by homotrimers of S-glycoproteins, each of which consists of two subunits, whereby S1 forms the part involved in receptor recognition, and S2 is highly conserved, anchors the protein in

the viral membrane and facilitates viral fusion. S1 contains a hypervariable loop which differs greatly between beta corona viruses on both size and sequence. Viral entry requires the proteolysis of the S protein in two locations, a process that utilizes host proteases, and results in irreversible conformational changes of the S protein. Some anti-SARS-CoV antibodies in humans mimic receptor engagement, thus modeling conformational S protein changes upon antigen-antibody interaction. The amino acid sequence of receptor binding sites of SARS-CoV2 is 74% homologous to that of SARS-CoV suggesting similar or even identical cell entry mechanisms for both viruses. The average diameter of virus is 125 nm.



Mechanism of Entrance :- Corona virus binds ACE2 cell surface of epithelial cells in the respiratory tract through its Spike proteins. CoV receptor binding mediates proteolytic cleavage followed by fusion with the host cell membrane. Viral RNA is then released into the host cell cytoplasm, where viral nucleoprotein uncoats. Viral RNA is translated to produce unglycosylated proteins. Proteins are trafficked through the Golgi body where they are glycosylated. Viral capsids assemble from viral RNA and N proteins in the cytoplasm. Vesicles fuse the cell membrane and release CoV virions into the lumen.

The high hACE2 binding affinity of RBD (Receptor Binding Disease) during preactivation of the spike and hidden RBD in the spike potentially allow SARS-CoV-2 to maintain efficient cell entry, while evading immune are surveillance contributing to the widespread of the virus.

Immunity :- The coordination of different cells, proteins, tissues, and organ of immune system provide immunity to the body against infectious organism and other invaders.

All living beings follow survival of the fittest concept and struggle for existence at all stages of evolution. As a part of their struggle for existence living

organisms acquired a defense system known as immunity system comprising of network of cells, tissues, and various organs that work together to protect the body. Blood and lymph systems are important in coordinating the function of immune system, Skin, mucous, damaged skin and mucosal layers are the possible roots of pathogen entry. If the immune system encounter a pathogen (germs, bacteria, fungi, molds or virus) it mounts immune response on the invader. Immune response is sparked by antigen. White Blood Cells (WBC) stored in lymphoid organs are on constant patrol looking for pathogens. On focusing the target they multiply and send signals to other cell types to do the same. WBCs are also called leukocytes.

Leukocytes :- Two categories of leukocytes are :

- **Phagocytes :** These cells surround & absorb pathogens and break them down.
- **Lymphocytes :** These cells help the body remember and recognize past invaders. Lymphocytes are further divided into two categories. B lymphocytes stay in bone marrow and develop B- cells to produce antibodies. T lymphocytes head to thymus and develop T-cells to destroy compromised cells in the body.

Types of Immunity :- There are three types of immunity in human namely :

- **Innate :** This is born level of immunity which attacks foreign invaders and is the first line of defense against pathogen.
- **Adaptive :** This is acquired immunity developed as we go through life. As we are exposed to drugs or vaccines, we develop an inventory of antibodies to different pathogens.
- **Passive :** This is temporary immunity borrowed from other source. Immune system is very complex and may have disorders which are:
- **Immuno-deficiencies :** These arise where one or more organs of the body immune system do not function.
- **Autoimmunity :** Here immune system wrongly targets Healthy cells rather than foreign pathogens or faulty cells.
- **Hypersensitivity :** Here immune system overreacts in a way that damages Healthy tissue.

Immune Tolerance :- Tolerance is the prevention of an immune response against a particular antigen. It is a state of unresponsiveness of the immune system to tissues that have the capability to elicit an immune response in a given organism.

Immune tolerance is important to sustain physiology. Central tolerance is the main way the immune system learns to discriminate self from non self. Peripheral tolerance is the key to prevent reactivity of the immune system to environmental entities.

Immunity Boosters :- Several enriched ways to increase immunity against SARS-CoV-2 are :

- Taking balanced nutritious diet
- Having sound sleep
- Taking Herbs
- Drinking sufficient water
- Doing regular exercises
- Practicing meditation
- Following regular schedule

Prevention, Diagnosis and Vaccination

Prevention :- Prevention is the best cure is a famous phrase. Spread of COVID-19 can be prevented by adhering to few guidelines, which are :

- Wear a face mask
- Wash hands regularly with soap for 20 seconds
- Keep social distancing
- Apply sanitizer
- Avoid going in social gatherings
- Avoid travelling
- Increase immunity

Diagnosis :- COVID-19 patients are generally symptomatic. After the exposure of SARS-CoV-2 symptoms take 2 to 14 days (incubation period) to appear. Recently many asymptomatic cases have been reported who were capable of spreading virus. FDA (Food and Drug Contol Administration) has recommended certain tests for Corona patients. Sampling is done by using a long swab to take a sample from the nose or throat. Sputum sample may also be collected.

Rapid Corona virus Diagnosis Test (RCDT) is recommended for quick results. Accuracy rate of RCDT is 40 %. At Centers for Disease Control, Reverse Transcription Polymerase Chain Reaction tests are performed with 81 % accuracy. FDA has also provided Home Testing Kit (HKT) and Rapid Diagnostic Test (RDT) for people in Self

Quarantine. CT Scan Tests of chest with 98 % accuracy are most dependable for the diagnosis of SARS-CoV-2.

Vaccination :- No vaccine has been developed so far to cure COVID-19. Vaccine development is at clinical test stage. It may further take six months to a year time for a vaccine to be available in market. In many countries, drugs and medicines tried on SARS-CoV and MERS-CoV are being used depending upon type of symptoms. Chloroquine and hydroxychloroquine are being tried in country like India and America. Few countries are using Remedesevir. In India some practitioners are providing Arsenic Album 30 for related symptoms.

For immunity boost up against corona virus, Divya Pharmacy of Patanjali has registered Coronil for oral use. Patanjali has also registered in its Corona kit, Swasari Bati and Anu Talia. Development of vaccine in India is in very advance stage. Indian Council of Medical Research (ICMR) in collaboration with Bharat Biotech India Ltd. (BBIL) will manufacture the vaccine. ICMR has derived it from strain of SARC-CoV-2 isolated by National Institute of Virology (NIV), Pune. Entire world has great aspirations from India, offering precatio for the success of COVAXIN. Made in India COVAXIN is likely to be launched on the eve of 15th August 2020.

Conclusion :- Researchers and Virologists believe corona virus has zoonotic background. COVID-19 is believed to be originated from wet market of Wuhan city, Hubei province, China. In a span of just three months China claimed to manage Wuhan as corona free while the whole world is still striving hard to invent preventive and curative measures to fight against pandemic.

The occurrence and development of SARS-CoV-2 depend on the interaction between the virus and the individual's immune system. Viral factors include virus types, mutation, viral load, viral titer and viability of the virus in vitro. The individual's immune system factors include genetics (such as HLA genes), age, gender, nutritional status, neuroendocrine-immune regulation and physical status. These factors all contribute to whether an individual is infected with the virus, the duration and severity of the disease, and the reinfection.

Although no vaccine and drug has come in market but in the early stages of the epidemic, accurate diagnosis helps control the spread of the disease. It is imperative to develop new, safe, accurate, fast, and simple new technologies for

detecting SARS-CoV-2. Of course, physicians will intentionally intervene in the two factors to make them develop into a direction beneficial to human health, which can help patients recover as soon as possible. However, it must not be considered that medical intervention can achieve a 100% curative effect.

Prevention is always treated as best cure. Strictly following the guidelines can help to control outbreak of SARC-CoV-2 spread. Epidemiological testing alongwith CT scan and RT-PRC tests can help accurate diagnosis.

Patanjali has registered a corona kit comprising of Coronil, Swasari Bati & Anu Talia as an effective immunity booster against COVID-19. ICMR and BBIL will jointly commence manufacturing of COVAXIN.

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