VIROLOGY - EXTRA STROKE CORONA VIRUS & COVID - 19

- 1. Coronaviruses or (CoV) → Viruses belonging to a large family, causing illness ranging from common cold to more severe diseases.
- 2. These diseases include:
 - Middle East Respiratory Syndrome or (MERS-CoV) and
 - Severe Acute Respiratory Syndrome or (SARS-CoV)

3. Novel Coronavirus or (nCoV)

- A novel Coronavirus or nCoV has been identified as a new strain that has not been previously identified in humans @ Cross over infection; Animal to Human
- An outbreak of unusual respiratory condition was first reported in Wuhan, China, due to the infection caused by novel Coronavirus, now known as COVID-19.
- The International Committee on Taxonomy of Viruses or I.C.T.V. announced "Severe
 Acute Respiratory Syndrome Coronavirus 2, or SARS CoV-2" as the name of the new
 virus.
- It is genetically associated with the Coronavirus that is responsible for the SARS outbreak of 2003.
- 11th February 2020, the World Health Organization or W.H.O., announced COVID-19
 as the name of this disease and the "COVID-19 virus" as the virus responsible for this
 disease.
- 4. Based upon the transmission rate, the W.H.O has declared the outbreak of the COVID-19 as a global health emergency.
- 5. Till now COVID-19 has affected many countries around the world → PANDEMIC DISEASE
- 6. Coronaviruses are a family of **POSITIVE SINGLE-STRANDED RNA VIRUS**, classified under **NIDOVIRALES ORDER**.
- 7. These viruses are enveloped and are round and sometimes pleomorphic of approximately 80 to 120 nanometer in diameter.
- 8. The virion contains an internal **HELICAL RNA-PROTEIN NUCLEOCAPSID** surrounded by an **envelope made up of lipids and viral glycoproteins**.
- 9. These glycoproteins are spike protein, membrane protein, and small membrane.
- 10. WHY IT IS CROWN SHAPE?
 - The spike protein or "S" is a type I glycoprotein that forms the peplomers on the virion surface, giving the virus its corona or crown-like morphology in the electron microscope
- 11. The coronaviruses attach to the cell surfaces through the spike.
- 12. In Coronaviruses, an additional protein hemagglutinin esterase is present whose function, is unknown.

13. The genome of Coronavirus

- ss RNA (+ve type)
- All Coronavirus genomes are arranged similarly with replicase locus encoded within 5dash end and the structural proteins encoded in the 3-dash end of the genome.

- **14.** The **VIRAL REPLICASE** is a huge protein complex comprising of 16 viral sub-units and **plays an** essential role in the coronavirus replication and transcription at the cytoplasmic membrane.
- 15. **COVID-19 is transmitted via droplets and fomites**. The transmission is through the respiratory droplets produced by the infected person when he or she sneezes or coughs
- 16. The main modes of transmission of Coronavirus are,
 - Person to Person → COVID -19 can be transmitted between people who are in close contact with one another or (within about 6 feet)
 - o Household transmission
 - From contact with infected surfaces or objects
- 17. As per the World Health Organization or W.H.O, a person might be susceptible to COVID-19 if he or she touches a surface or object containing the virus and then touching their own mouth, nose, or face.

18. Clinical Presentation of Coronavirus

- According to the Centre for Disease Control or CDC, patients above the age of 50 are more vulnerable to the attack,
- Persons with underlying diseases like Diabetes, Parkinson's disease and Cardiovascular diseases are at high risk.
- As per the WHO the median age of affected people is 51 years
- o 51.1% of the affected population are males.

19. PATHOGENESIS OF COVID-19

- The pathogenesis of Coronavirus begins with binding of the virus to the cell surface receptor through the S-Protein, followed by fusion of the virus envelope to the cell membrane.
- Following the fusion, the RNA is released into the host cell.
- The first step includes genome RNA translating into viral replicase polyproteins pp1a and 1ab.
- After transcription and translation, the viral proteins and genome RNA form an assembly in the endoplasmic reticulum and Golgi complex and is finally released out of the cell by exocytosis.
- The virus particles have an affinity to infect the lungs, through the blood stream.
- They also involve the liver and kidney.

20. There are 3 different phases in which the viral particles affect the lungs.

- 1. Viral replication
- o 2. Activation of Immune System
- 3. Pulmonary destruction.

21. Viral Replication phase

- Coronavirus rapidly invades human lung cells which are of two types, the mucous cells and cilia.
- Mucous cells are defensive and protect the lungs by removing the virus.
- The cilia are infected by the virus particles, which fill the patient's airway with debris and fluids. As a result, the patient experiences symptoms like SHORTNESS OF BREATH.

22. Activation of Immune System

- Various cytokines and inflammatory mediators are released which provide immunity.
- o In cases of reduced immune response, the virus particles clog the lungs and worsen the condition.

23. Pulmonary destruction phase

There is damage to the lungs resulting in respiratory failure.

24. WHY DIARRHEA in COVID -19 →

• Once the virus enters the intestine, it multiples by binding to the cell surface receptors causing damage and resulting in diarrhea.

25. The effect of virus on other parts of the body results in:

- Low white blood cell count & Low Platelet count
- Low blood pressure
- Elevated liver enzymes
- Acute kidney injury, and
- Cardiac arrest.

26. Clinical Features of COVID-19

- Decreased white blood cells,
- Coughing and sneezing & Runny nose,
- o Shortness of breath & breathing difficulties,
- Sore throat, Fever & Fatique,
- o Pneumonia,
- Severe acute respiratory syndrome,
- Lungs inflammation and congestion,
- o Cardiovascular damage, Diarrhea, Decreased Kidney functions and Kidney failure
- 27. COVID-19 shows the symptoms of stuffy nose, sore throat, fever, chills, headache, and diarrhea, which MIMIC THE SYMPTOMS OF THE COMMON COLD, INFLUENZA AND SARS.
- **28.** If the patient is presented with mild symptoms of corona virus, the respiratory symptoms include cough, sore throat and fever.
 - The radiological findings are observed as multifocal patchy ground glass opacity with subpleural distribution.
- 29. In case of severe Coronavirus, the respiratory symptoms include breathlessness and respiratory failure.
- 30. In addition to that, fever, muscle ache, confusion and headache will be the common symptoms.

31. Diagnosis of COVID - 19

- The immediate approach to establish a diagnosis should emphasize on three important factors:
 - Early recognition,
 - Immediate isolation, and
 - Introducing infection control measures.
- The prime suspects for COVID-19 include patients with fever and lower respiratory tract symptoms.

- 32. The geographical distribution and recent contact with the suspected patients should also be taken into consideration.
- 33. The clinical criteria for confirming the diagnosis of the severity of Coronavirus is broadly categorized into four types: mild, moderate, severe, and critical.
- 34. For the mild type, the symptoms include fever less than 38 degrees centigrade.
- 35. In case of moderate type, the patient may be presented with fever, respiratory symptoms and imaging findings of pneumonia.
- 36. If the patient is affected severely with corona virus then any of the below mentioned findings can be observed:
 - Respiratory distress
 - Oxygen saturation of less than 93% at rest
 - o Partial pressure of oxygen, and
 - o fraction of inspired oxygen less than or equal to 300 millimetres of mercury.
- 37. In case of critical condition, the findings can be respiratory failure, shock and extra pulmonary organ failure. Intensive care unit is necessary.
- 38. Early Investigations and Methods
 - Respiratory material from upper and lower respiratory tract must be collected.
 - The upper respiratory tract specimen includes NASOPHARYNGEAL / OROPHARYNGEAL SWAB, or wash in ambulatory patients.
 - The lower respiratory tract specimens include sputum and or endotracheal aspirate.
 - Other methods of collection include blood and stool.
 - The specimens are to be collected in sterile containers
 - must be stored at 2 to 8 degree centigrade.
 - In case of delay, the specimens are frozen at minus 20 degree centigrade and then shipped
 - Laboratory Investigations
 - Nucleic acid amplification tests or NAAT tests → by Real Time Reverse Transcription Polymerase Chain Reaction or RT-PCR for COVID 19 to check for evidence of viral load indicating active infection.
 - Serological testing for detecting antibodies.
 - Viral Sequencing, and, Viral culture.
- 39. The key preventive measures are to follow good hygiene practices.
- **40. PREVENTIVE MEASURES**
 - Washing hands with soap and water, or alcohol-based hand-rub; and,
 - Offering a surgical mask to a person who is coughing or sneezing.
 - Follow respiratory hygiene or cough etiquette, that is, cough or sneeze into the inside of elbow or arms
 - N-95 mask is indicated for health professionals only when anticipating or participating in aerosol-generating procedures, that is, intubation, extubation, bronchoscopy, open suction, or nasopharyngeal or throat sampling.
 - Avoid nebulization, and chest physiotherapy.
 - Keep the workplace clean and hygienic.