

## Introduction

According to the World Health Organization (WHO), viral diseases continue to emerge and represent a serious issue to public health. In the last twenty years, several viral epidemics such as the severe acute respiratory syndrome coronavirus (SARS-CoV) in 2002 to 2003, and H1N1 influenza in 2009, have been recorded. Most recently, the Middle East respiratory syndrome coronavirus (MERS-CoV) was first identified in Saudi Arabia in 2012.

In a timeline that reaches the present day, an epidemic of cases with unexplained low respiratory infections detected in Wuhan, the largest metropolitan area in China's Hubei province, was first reported to the WHO Country Office in China, on December 31, 2019. As they were unable to identify the causative agent, these first cases were classified as "pneumonia of unknown etiology." The Chinese Center for Disease Control and Prevention (CDC) and local CDCs organized an intensive outbreak investigation program. The etiology of this illness is now attributed to a novel virus belonging to the coronavirus (CoV) family.

On February 11, 2020, the WHO Director-General, Dr. Tedros Adhanom Ghebreyesus, announced that the disease caused by this new CoV was a "COVID-19," which is the acronym of "coronavirus disease 2019". In the past twenty years, two additional coronavirus epidemics have occurred. SARS-CoV provoked a large-scale epidemic beginning in China and involving two dozen countries with approximately 8000 cases and 800 deaths, and the MERS-CoV that began in Saudi Arabia and has approximately 2,500 cases and 800 deaths and still causes as sporadic cases.

## Escalation of an Epidemic to a Pandemic

The World Health Organization (WHO) will declare a Pandemic when a disease has shown exponential growth - dramatically increasing rate of growth, each day showing many more cases than the previous day. A current example of this is the Coronavirus Disease (COVID-19). On 31 December 2019, a cluster of cases of pneumonia of unknown cause, in the city of Wuhan, Hubei province in China, was

reported to the WHO. This was subsequently identified as a new virus in January 2020 and over the following months, the number of cases continued to rise but were not contained to China and showed exponential growth worldwide. Due to the rapid global rise in cases, this was declared a pandemic on 11 March and as of 15 March 2020, over 150,000 cases had been identified globally in 123 countries with over 5,000 fatalities.

## Stages of a Pandemic

The WHO has identified six phases that it follows before declaring a pandemic. Phase 1 represents a low risk and phase 6 is a full-blown pandemic, you can see the phases below:

**Phase 1** - a virus is seen in animals but has not been shown to infections in humans

**Phase 2** - a known animal virus has caused an infection in humans

**Phase 3** - scattered or isolated incidence of cases or small clusters of the disease occurring in humans; possible cases of human-to-human transmission but not at a level to cause community-level outbreaks

**Phase 4** - human to human transmission at a rate that causes an outbreak in communities

**Phase 5** - the spread of the disease between humans is now evident in more than one country

**Phase 6** - community-level outbreaks are in at least one additional country other than that seen in phase 5.

Once Phase 6 is reached preparation is then made for a global pandemic. Each phase has a list of actions that need to be followed to facilitate transparency and the education of health organisations and members of the public

## Transmission

The initial cases were presumably linked to direct exposure to infected animals (animal-to-human transmission) at a seafood market in Wuhan, China. However, clinical cases with diversity in exposure history have emerged. This helps further elaborate that human-to-human transmission of the virus is also possible. Therefore, human-to-human transmission is now considered the main form of transmission. Individuals who remain asymptomatic could also transmit the virus. However, the most common source of infection is symptomatic people. Transmission occurs from the spread of respiratory droplets through coughing or sneezing. Data also suggest that close contact between individuals can also result in transmission. This also indicates possible transmission in closed spaces due to elevated aerosol concentrations.

## Pathophysiology

Pathophysiology and virulence mechanisms of CoVs, and therefore also of SARS-CoV-2 have links to the function of the nsps and structural proteins. For instance, research underlined that nsp is able to block the host innate immune response. Among functions of structural proteins, the envelope has a crucial role in virus pathogenicity as it promotes viral assembly and release. However, many of these features (e.g., those of nsp 2, and 11) have not yet been described.

Among the structural elements of CoVs, there are the spike glycoproteins composed of two subunits (S1 and S2). Homotrimers of S proteins compose the spikes on the viral surface, guiding the link to host receptors. Of note, in SARS-CoV-2, the S2 subunit — containing a fusion peptide, a transmembrane domain, and cytoplasmic domain — is highly conserved. Thus, it could be a target for antiviral (anti-S2) compounds. On the contrary, the spike receptor-binding domain presents only a 40% amino acid identity with other SARS-CoVs. Other structural elements on which research must necessarily focus are the ORF3b that has no homology with that of SARS-CoVs and a secreted protein (encoded by ORF8), which is structurally different from those of SARS-CoV.

## Diagnosis

The U.S. CDC has developed criteria for persons under investigation (PUI). If a person is deemed a PUI, immediate prevention and infection control measures are undertaken. Epidemiological factors are used to assess the requirement of testing. These include close contact with a laboratory-confirmed patient within 14 days of symptoms or travel history to an infected area within 14 days of symptom onset.

The WHO recommends collecting samples from both the upper and lower respiratory tracts. This can be achieved through expectorated sputum, bronchoalveolar lavage, or endotracheal aspirate [4]. These samples are then assessed for viral RNA using polymerase chain reaction (PCR). If a positive test result is achieved, it is recommended to repeat the test for re-verification purposes. A negative test with a strong clinical suspicion also warrants repeat testing.

## Treatment

There is no specific antiviral treatment recommended for COVID-19, and no vaccine is currently available. The treatment is symptomatic, and oxygen therapy represents the major treatment intervention for patients with severe infection. Mechanical ventilation may be necessary in cases of respiratory failure refractory to oxygen therapy, whereas hemodynamic support is essential for managing septic shock.

## Supportive Treatment

Among other therapeutic strategies, systemic corticosteroids for the treatment of viral pneumonia or acute respiratory distress syndrome (ARDS) are not recommended. Moreover, unselective or inappropriate administration of antibiotics should be avoided, although some centers recommend it. Although no antiviral treatments have been approved, several approaches have been

proposed such as lopinavir/ritonavir (400/100 mg every 12 hours), chloroquine (500 mg every 12 hours), and hydroxychloroquine (200 mg every 12 hours). Alpha-interferon (e.g., 5 million units by aerosol inhalation twice per day) is also used.

Preclinical studies suggested that remdesivir (GS5734) — an inhibitor of RNA polymerase with in vitro activity against multiple RNA viruses, including Ebola — could be effective for both prophylaxis and therapy of HCoVs infections.[18] This drug was positively tested in a rhesus macaque model of MERS-CoV infection.

## Role of Physiotherapy in Corona Virus Disease 2019

As with any patient displaying respiratory symptoms, it may be necessary to provide treatment to relieve symptoms and improve function. The secretion load of people with COVID-19 is low so they don't usually require invasive or intensive airway clearance techniques. Physiotherapy support is more focused on non-invasive ventilation support measures and then the rehabilitation phase.

In the mild and moderate stages of disease, normal oxygen supportive measures (facemask oxygen) may be advantageous. Patients with severe pneumonia often need oxygenation support. High flow nasal oxygen is recommended at this stage, in conjunction with negative pressure room (if available). Nebulisation is not recommended.

Some patients may go on to develop ARDS. Noninvasive ventilation (NIV) is not routinely recommended and these patients usually warrant intubation with mechanical ventilation. Prone positioning may assist ventilation and closed suctioning is recommended. Extracorporeal membrane oxygenation may be indicated in patients with refractory hypoxia.

During the acute phase of COVID 19, Lazzeri et. al. suggest any interventions that could potentially increase the risk of breathing are contraindicated and should be avoided. Once stable and no longer in the , if indicated the main goal in respiratory physiotherapy is to mobilize secretions and ease the work of

breathing. Interventions may include techniques such as positioning, autogenic drainage, deep breathing exercises, breath stacking, active cycle of breathing mobilization and manual techniques (e.g. percussion, vibrations, assisted cough) to aid sputum expectoration. These interventions can be performed at any stage of the disease where appropriate and safe to perform.

The most common complication in severe COVID-19 patients is severe pneumonia, but other complications may include Acute Respiratory Distress Syndrome (ARDS), Sepsis and Septic Shock, Multiple Organ Failure, including Acute Kidney Injury and Cardiac Injury, which are more prevalent in at-risk groups including Older Age (> 70 years) and those with Co-morbid Diseases such as Cardiovascular Disease, Lung Disease, Diabetes and those who are Immunosuppressed.

Physiotherapy may be beneficial in the respiratory treatment and physical rehabilitation of patients with COVID-19, although a productive cough is a less common symptom, physiotherapy may be indicated if patients with COVID-19 present with airway secretions that they are unable to independently clear. This may be evaluated on a case- by-case basis and interventions applied based on clinical indicators, and may also be utilized in high risk individuals e.g. patients with existing comorbidities that may be associated with hypersecretion or ineffective cough (e.g. neuromuscular disease, respiratory disease, cystic fibrosis etc).

Physiotherapy will have a strong role in providing exercise, mobilization and rehabilitation interventions to survivors of critical illness myopathies associated with COVID-19 in order to enable a functional return to home.

### **Physiotherapy Specific Aerosol Generating Techniques**

Manual Techniques (e.g. Percussion/Manual Assisted Cough) that may lead to coughing and expectoration of sputum

Use of Positive Pressure Breathing Devices (e.g. IPPB), Mechanical Insufflation-Exsufflation (Cough Assist) Devices, Intra/Extra Pulmonary High Frequency Oscillation Devices (e.g. the Vest / MetaNeb / Percussionaire etc.)

Any Mobilization or Therapy that may result in Coughing and Expectoration of Mucus

Any Diagnostic Interventions that involve use of Video Laryngoscopy that can result in Airway Irritation and Coughing (e.g. Direct Visualization during airway clearance techniques or when assisting Speech and Language Therapists perform Fibreoptic Endoscopic Evaluation of Swallow)

## Prevention

General prevention measures

- The only way to prevent infection is to avoid exposure to the virus and people should be advised to-
- Wash hands often with soap and water or an alcohol-based hand sanitiser and avoid touching the eyes, nose, and mouth with unwashed hands
- Avoid close contact with people (i.e., maintain a distance of at least 1 metre [3 feet]), particularly those who have a fever or are coughing or sneezing
- Practice respiratory hygiene (i.e., cover mouth and nose when coughing or sneezing, discard tissue immediately in a closed bin, and wash hands)
- Seek medical care early if they have a fever, cough, and difficulty breathing, and share their previous travel and contact history with their healthcare provider
- Avoid direct unprotected contact with live animals and surfaces in contact with live animals when visiting live markets in affected areas
- Avoid the consumption of raw or undercooked animal products, and handle raw meat, milk, or animal organs with care as per usual good food safety practices.

Screening and quarantine

- People traveling from areas with a high risk of infection may be screened using questionnaires about their travel, contact with ill persons, symptoms of infection, and/or measurement of their temperature. Combined screening of airline passengers on exit from an affected area and on arrival elsewhere has been

relatively ineffective when used for other infections such as Ebola virus infection, and has been modeled to miss up to 50% of cases of COVID-19, particularly those with no symptoms during an incubation period, which may exceed 10 days. Symptom-based screening processes have been reported to be ineffective in detecting SARS-CoV-2 infection in a small number of patients who were later found to have evidence of SARS-CoV-2 in a throat swab.

- Enforced quarantine has been used in some countries to isolate easily identifiable cohorts of people at potential risk of recent exposure (e.g., groups evacuated by aeroplane from affected areas, or groups on cruise ships with infected people on board). The psychosocial effects of enforced quarantine may have long-lasting repercussions.

*Online and offline Sources-*

*WHO, PhysioPlus,NCBI*

*Course Prepared by-*

*I.A.C.P.*

*Indian Association of Chartered Physiotherapists*

**--- Thank You ---**

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