CORONAVIRUS DISEASE - AN UPDATE

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ABSTRACT The new pandemic outbreak that started in the second half of December 2019 is a recent addition to the several new diseases such as Ebola virus, Zika virus, Nipah virus and coronaviruses that appeared in the last two decades in various geographical regions. However, the genomic sequencing did not match with earlier sequenced CoVs, signifying a novel CoV strain, which has been termed as severe acute respiratory syndrome CoV-2(2019-nCoV). The disease is highly contagious, unlike the earlier ones and usually spreads from droplet infections. About 80% of infections are mild or asymptomatic, 15% are severe infection, requiring oxygen and 5% are critical infections, requiring ventilation. As of today, no specific antiviral agent or vaccine is available to treat this COVID-19. The treatment regimens used mostly comes from previous experience of usage of drugs for earlier coronavirus diseases (SARS and MERS). Here we discuss the pathophysiologic, diagnostic, clinical presentation, management, vaccine and preventive aspects of COVID-19.

KEYWORDS Covid-19, pandemic, SARS-CoV-2, Cytokine storm

INTRODUCTION

The end of the year 2019 witnessed a deadly viral disease, namely COVID-19. First reported from the Wuhan city of China and later spread to all over the world. As of 30th July 2020, 17,189,755 cases reported from 213 countries and territories, out of which 10,701,141 cases recovered and 670,256 died due to the disease. Out of the total number reported; 5,818,358 are currently infected, of which 1% are serious or critical and remaining 99% are in mild condition. Of the total number of cases reported, the highest number of cases are reported from United States of America (4,568,037) followed by Brazil (2,555,518) and India (1,584,384). In United Arab Emirates 59,921, cases are reported as of 30th July 2020 with 53,202 recovered cases and 6,372 active cases. The death rate due to COVID-19 in the United Arab Emirates is 0.61%, which is much lower than the reported death rate in many other countries [1]. The common cold is a viral infection of the upper respiratory tract. The virus that causes common cold is rhinovirus, human coronaviruses, influenza viruses, adenoviruses, human respiratory syncytial virus, enteroviruses other than rhinoviruses, human parainfluenza viruses, and human metapneumovirus.

The first report of coronavirus disease emerged in North America, and it happened in the late 1920s. It emerged as an acute respiratory infection of domesticated chickens. [2]. In the year 1931, Arthur and Hawn gave a detailed report of new respiratory infection of chickens in North Dakota. The new-born chicks had symptoms such as gasping and listlessness with high death rates of 40–90%.[3]. Two more animal coronaviruses that cause brain disease (murine encephalitis) and mouse hepatitis virus (MHV) that causes hepatitis in mice were discovered in the late 1940[4].

In 1960, human coronaviruses were discovered, and the virus could not be cultivated using standard techniques which had successfully cultivated rhinoviruses, adenoviruses and other known common cold viruses. These viruses were morphologically related by their general shape and distinctive club-like spikes. Following this, several coronaviruses have been discovered, including severe respiratory syndrome(SARS-CoV) in 2003, middle east respiratory syndrome(MERS-CoV) in 2013, and SARS-CoV-2 in 2020[5].

It is evident from the preceding paragraph that the COVID-

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19 is the third coronavirus disease to emerge in humans during the past two decades, the first two beings: a) the severe acute respiratory syndrome (SARS) coronavirus outbreak in 2002 and b) the Middle East respiratory syndrome(MERS) coronavirus outbreak in 2012[6]. SARS and MERS have been reported to have higher mortality rates than COVID-19. However, COVID-19 is more contagious when compared to SARS and MERS, resulting in higher case numbers. Even though the mortality rate of SARS-CoV-2 is low compared to SARS and MERS, the total decease rate due to SARS-CoV-2 is far greater matched to another two-corona virus disease.

Fifth January 2020, the WHO announced the first bulletin of an epidemic of the unidentified source. Within a month, WHO had confirmed that COVID-19 is a community health disaster [7]. Soon after China reported the outbreak and shared the details of the disease, the World Health Organization acted quickly and started issuing guidelines on prevention, diagnosis and management daily. On 11.02.2020, WHO named the pandemic as COVID-19. Following this, all the countries around the world acted promptly with precautionary measures such as home isolation, social distancing etc. Governments across the world have responded with varying degrees of social distancing measures in a move to limit the spread of the disease [7]. Diseases ranging from the common cold to more life-threatening diseases such as COVID-19, SARS and MERS are due to a huge family of viruses, namely coronaviruses[8].

In addition to the death caused directly by COVID-19, the resulted healthcare interference caused by it could lead to significant increase mortality due to human immunodeficiency virus, Mycobacterium tuberculosis and malaria in the coming years [9].

ETIOLOGY

COVID-19 viruses are positive-stranded RNA viruses with a crown-like appearance under an electron microscope (coronam is the Latin term for crown) due to the presence of spike glycoproteins on the envelope.[Figure 1] These viruses possess a bulky plus filament RNA of 27-32 kb size, which are covered and polyadenated with 80-160 nm diameter [10,11]. The coronavirus has 5'-covered structure and 3' poly-A tail [12]. The viruses have surface projections that shelter the whole exterior of the virus and about 20nm in length [10]. The spike protein, a type I membrane glycoprotein, creates peplomers and has a very vital role in the infectivity of the virus [10,13]. The spike proteins exhibit a high rate of transmutation, whereas all other structural proteins are well-preserved [14].

Animals infected with coronaviruses can spread to humans and then spread between people. Although the infection spreading from animal to human is rare, this occurred with the current outbreak of COVID-19, but it originally came from the bat. The first reported infections were linked to a live animal market, but the virus is now spreading from human to human. [15] Notwithstanding the structural resemblances amongst the coronavirus family, the beta coronaviruses subtypes are involved in the three major epidemics in the last decade. Both SARS-CoV and COVID-19 share a similar receptor, namely, angiotensin-converting enzyme receptor (ACE2) in the lungs that can easily explain the common signs and symptoms seen in a patient infected with them. Genomic characterization has shown that probably bats and rodents are the gene sources of alphaCoVs and betaCoVs. On the contrary, avian species seem to represent the gene sources of deltaCoVs and gammaCoVs.

PATHOGENESIS

The incubation period of COVID-19, which is the time between exposure to the virus and symptom onset, is on average 5-6 days but can be as long as 14 days. Thus, quarantine should be in place for 14 days from the last exposure to a confirmed case. COVID-19 spreads between people through direct, indirect (through contaminated objects or surfaces), or close contact with infected people via mouth and nose secretions. The disease can be contacted by any person through tiny globules discharged from the nose and mouth of an infected individual when one coughs or sneezes [16,17]. Around 3000, globules can be produced by a single cough or sneeze [17]. These globules may occupy the different surrounding types of surfaces, including the patients himself, and the virus may remain there active for several hours depending on the surfaces. The active virus can be identified on steel and plastic surfaces for up to seventy-two hours, on paper and cards for up to twenty-four hours [18]. Disinfection of surfaces with alcohol (60-70%) will inactivate the coronavirus rapidly (< 1minute) [17]. It was reported that SARS-CoV2 remains virulent in airborne droplets for a minimum of three hours [19]. Even though the spread from various surfaces is not the main route of transmission of COVID-19, it is better to keep away from these surfaces. Handwashing with correct technique is preferred over hand purifiers and alcohol rubs to sanitize the hands. Further, it is advised not to touch mouth and nose with hands [18,19].

After the entry virus via respiratory droplets, it reaches the lungs through the bronchial tree. After reaching alveoli, the COVID-19 binds specifically to the ACE2 receptor, present on the pneumocyte type II. The binding of viral particles to pneumocytes type II results in viral replication and budding of the pneumocytes type II. During this process, the pneumocytes are destroyed, and inflammatory mediators are released. The inflammatory mediators stimulate the macrophages, which in turn release cytokines (interleukin-1, interleukin-6 and tissue necrosis factor-alpha). These intermediaries may cause fever and smooth muscle relaxation along with contraction of blood vessel endothelial cells and increase capillary porousness resulting in pulmonary oedema [20]. As a result of alveolar oedema and increased surface tension due to destruction of pneumocytes, the lung will collapse, and gas exchange will be reduced, leading to refractory hypoxemia. Increased work to overcome impaired oxygenation will result in acute respiratory distress syndrome (ARDS).

Consolidation of lung tissue will follow as the disease progress that further impairs gas exchange, causing hypoxemia [21]. This hypoxemia will trigger chemoreceptor and cause sympathetic nervous system stimulation resulting in increased respiratory rate and heart rate. Further, the patient will have productive cough and dyspnea due to lung consolidation.

The next complication observed in nearly 70% non-survivors of COVID-19 infected patients is disseminated intravascular coagulation (DIC). DIC is a manifestation of clotting defect and a transitional link in the progress of multi-organ failure (MOF) [22].

The cytokine-mediated peripheral vasodilatation results in decreased total peripheral resistance, triggering significant hypotension. The decreased blood pressure will result in decreased tissue perfusion to all the vital organs that may progress to multi-organ failure [23]. The renal failure that follows will lead to a rise in blood urea nitrogen and creatinine. The increased concentration of cytokines in the hypothalamus causes increased

prostaglandin synthesis and release. This causes fever, and this will be one of the initial symptoms of COVID-19.

CLINICAL FEATURES OF COVD-19

A) Asymptomatic

B) Symptomatic

a) Mild illness

b) Moderate illness (pneumonia but not severe)

c) Severe illness with various syndromes

- Severe Pneumonia
- ARDS
- Sepsis
- Septicemic shock
- Multi organ failure (including cardiac and renal injury)
- Vasculopathy, Hypercoagulability, Ventilation Perfusion Mismatch.

Most common clinical features of coronavirus disease are hyperpyrexia, cough, dyspnoea, myalgia and weakness. Besides, there may be sore throat, nose block, malaise and headache. The atypical presentation may include symptoms like altered taste, anosmia, diarrhoea. Nevertheless, patients of mild Covid usually do not have any signs of dehydration, sepsis, shortness of breath and hypoxia. Presence of these symptoms should alert one to the possibility of more severe Covid and possible associated organ failure [24, 25, 26].

However, one must remember

1. There may be no symptoms whatsoever
2. A sore throat alone is unlikely to be Covid – usually, there are some accompanying symptoms
3. Fever alone is also unlikely to be Covid.
4. Loss of taste and smell alone does not suggest Covid. When they are associated with Covid usually, it suggests a mild Covid without a stormy course.
5. Though we expect respiratory symptoms, diarrhoea can be the presenting symptom in Covid-19 with an atypical presentation.
6. Tachypnoea (>30/min) and decrease in O2 saturation (< 93% at rest) indicate serious disease with more than 50% lung involvement needing hospitalization.
7. Presence of severe headache with confusion, severe abdominal pain, nausea and vomiting, severe chest pain, hemoptysis may indicate organ damage or failure.
8. ARDS/Respiratory failure, shock, encephalopathy, cardiac failure/myocardial injury, coagulopathy, acute kidney injury, rhabdomyolysis indicate critical illness in Covid.

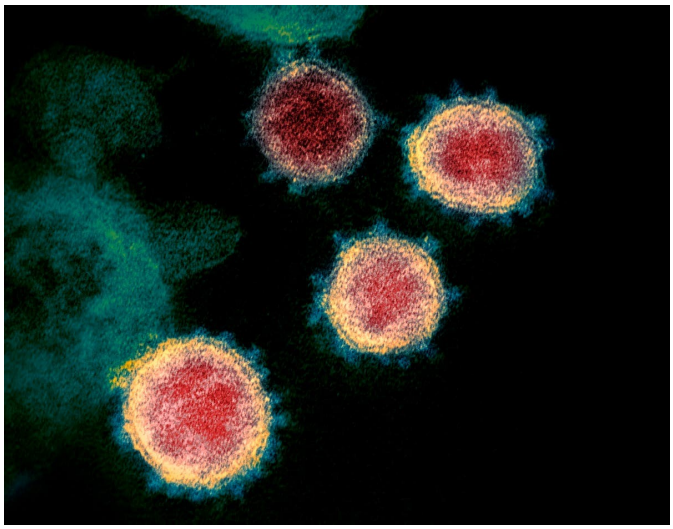

Fig. 1: This electron microscope image made available by the US National Institutes of Health in February 2020 shows the virus that causes COVID-19. (AP). Credit: NIAID-RML.

THE STAGES OF COVID-19 INFECTION INCLUDE [27]:

I Early infection

II Pulmonary: Early and Late

III Severe inflammation phase

Persons in the stage of early infection (incubation period and those who have asymptomatic infections) harbour the virus, which can multiply and spread the disease. This phase may or may not progress. On progression, lungs may be involved causing pneumonia. The pulmonary phase of illness may be due to viral effects, bacterial infection, or immunologic effects. Depending on the severity, this pulmonary phase of the disease can produce various degrees of hypoxia. The early pulmonary phase may produce mild hypoxia. The late pulmonary phase may be followed by a phase of hyperimmune response associated with immune dysregulation and is a severe manifestation of the disease resulting in progressive hypoxia. Therefore, it must be borne in mind that hypoxia may not be there in asymptomatic and mild cases, mild hypoxia in mild cases and severe hypoxia in severe cases. Hypoxia in mild cases may occur due to impaired oxygen transfer due to exudate in alveoli. In severe cases, it can be due to impaired oxygen transfer and due to thrombosis in the pulmonary circulation triggered by inflammation (Table 1). The viral response is highest in the beginning, gradually decrease, and almost disappears by the end of the second stage. Host inflammatory response will begin in the second stage and reaches its peak towards the end of the third stage.

DIFFERENTIAL DIAGNOSIS (28)

Flu, Common cold, allergy may mimic Covid-19 and are close contenders at least in the early symptomatic part of the illness.

COVID-19: The presence of dry cough, fever, and some breathlessness with the possible association of body ache headache, sore throat and fatigue, points towards Covid-19. Diarrhoea is a rare occurrence.

Table 1 The stages of COVID-19

Signs, symptoms Lab & imaging parameters	Stage 1 (Early infection)	Stage 2 (Pulmonary Phase)	Stage 3 Severe inflammation Phase
Clinical symptoms	Mild symptoms Temp. >99.60° F Dry cough, diarrhoea, headache	Breathlessness, Hypoxia	ARDS, Shock, heart failure
Clinical signs	Lymphopenia, increased prothrombin time, increased D-Dimer and LDH	Abnormal chest imaging, elevated Transaminases, Low-normal procalcitonin	Elevated inflammatory markers(CRP, IL-6, Ferritin) Troponin, NT-proBNP elevation.

COMMON COLD: Presentation with a sore throat, body ache, joint pain, running nose, sneezing and mild dry cough point towards common cold. Fever is rare.

FLU: Fever, sore throat, headache, body ache, fatigue and running nose indicate the possibility of Flu. Shortness of breath is very unlikely.

ALLERGY: Sneezing, wheezing with shortness of breath and dry cough indicate an allergy.

DIAGNOSIS

Laboratory tests available: Antigen test - PCR for viral RNA and Antibody tests – IgM and IgG.

PCR positivity indicates the presence of viral RNA. In the early phase, it indicates a possible active infection. Sometimes the patients can continue to test positive even after days or weeks – this phenomenon is called Lingering RNA. It does not indicate infectivity even if the patient may have symptoms. A repeated positive result in a single patient may be counted as a new case. This is called Compounding effect and must be carefully documented. A negative PCR test does not rule out infection. The negative result must be correlated with the clinical symptoms and must be repeated. A false-negative test is a real problem. 30% of PCR tests may be false negative on day 4.

Antibody tests serve as tools of surveillance. They must never be used in isolation to diagnose infection. Used in conjunction with a clinical scenario and the PCR test, they help in the identification of the stage of infection and recovery. Tests should never be interpreted in isolation. One must always correlate the results of Covid-19 related lab tests with the clinical features.

There are 10 possible scenarios

1. PCR+ IgM+ IgG- = Early phase of infection
2. PCR+ IgM- IgG+ = Active phase of infection
3. PCR+ IgM- IgG- = Window period / Early stage of infection: Correlate clinically
4. PCR- IgM- IgG- = Early phase of infection: PCR may be false negative
5. PCR not done IgM+ IgG- = May be early phase of infection – Get PCR done
6. PCR not done IgM+ IgG+ = Active phase of infection- Get PCR done
7. PCR- IgM+ IgG+ = Recovery phase of infection
8. PCR- IgM- IgG+ = Post Covid infection Recovery
9. PCR- IgM+ IgG= = Post Covid infection Recovery / False negative Covid
10. PCR- IgM- IgG- = Not infected / Early infection – Needs clinical correlation

IMAGING STUDIES

CT SCAN CHEST

A) CT scan chest is a helpful aid when it shows typical changes. Even though the CT scan is helpful, it should never be used to diagnose Covid-19 infection or infectivity in isolation.

Three classical changes may be seen as follows:

1. Ground glass opacities (Vessels are seen through opacity) Location: Posterior & Peripheral
2. Progressively increasing Crazy Paving - Septal thickening on the background of ground-glass opacity
3. Reverse Halo sign - Peripheral low attenuation and Central high attenuation – Organizing pneumonia

Severity grading using CT Scan chest: the location, extent and overall distribution of typical lesions on the CT scan. A scoring system is used, taking into consideration these criteria. More significant the percentage of involvement, the more severe is the illness.

B). Chest X-Ray: It is a helpful tool in the settings where a CT scan is not easily available. Rounded opacities located regions peripherally posteriorly indicate the possibility of Covid-19 active infection. However, this has to be correlated with the clinical scenario, PCR test and must be followed by a CT scan chest.

C). Complete Blood Count:

Eosinopenia: (<100 cells /microlitre): Suggests the diagnosis, indicator of higher mortality.

Eosinophilia: (>400cells/ microlitre): Associated with milder symptoms and Improved survival.

Lymphopenia: Severity and mortality predictor.

Neutrophilia: Can predict and be associated with hyper immune response

Low platelets & Low fibrinogen: Associated with DIC. In DIC these can be linked with raised Fibrinogen, D dimer, IL-6 and interferon levels in the blood. This may happen in late pulmonary phase with cytokine storm or Macrophage Activation Syndrome(MAS).

Serum ferritin level: High level of serum ferritin is indicative of cytokine storm, and prognosis will be poor. Patients with diabetes mellitus have a high level of ferritin and are more likely to have severe complications from COVID-19. It also helps to decide on when to start IL-6 inhibitors.

D). Other tests: Organ function tests may be required in multi-organ failure complicating Covid-19 or when the comorbid conditions such as diabetes mellitus, obesity, hypertension etc. are present.

COMPLICATIONS

There are two structures mainly involved in Covid-19 infection:

A) Pulmonary Complications

B) Extrapulmonary complications

Involvement of the lung was known and noticed right from the beginning of the epidemic. What was missed out was the involvement of the endothelium, which explains seemingly bizarre presentations and complications involving seemingly unrelated organs.

PULMONARY COMPLICATIONS

1. Pneumonia: With variable causes- Viral infection, bacterial infection, inflammation. Thrombosis of lung vessels triggered by the Covid-19 can mimic, coexist and or complicate pneumonia.

2. Acute respiratory distress syndrome (ARDS): The release of pro-inflammatory cytokines and chemokines by immune effector cells trigger a violent inflammatory immune response (cytokine storm) that contributes to ARDS, multiple organ failure, and finally death in severe cases [30, 31].

3. Cytokine storm may cause leucocytosis, abnormal respiratory findings, and increased levels of plasma pro-inflammatory cytokines causing damage to lungs and multiple organs of the body: heart, kidney and liver, leading to multiple organ failure [32]

4. Vascular thrombosis - Early phase of ARDS is diffuse and is characterized by alveolar damage with edema, hemorrhage, and intra alveolar fibrin deposition [33], fibrin thrombi, microangiopathy [33] DIC, large vessel thrombosis and MOF [34]

A. EXTRA PULMONARY COMPLICATIONS [35]

1. Endothelial damage leading to deep vein thrombosis, acute pulmonary embolism, thromboembolism and catheter induced thrombosis.

2. Cardiac complications such as myocarditis, ischemia, cardiomyopathy, arrhythmias, cardiogenic shock and acute cor pulmonale.

3. Endocrine: Hyperglycaemias (Pancreatic failure) and diabetic ketoacidosis.

4. Dermatological: Petichiae, urticarial and livedo reticularis

5. Neurologic: Aguesia, anosmia, stroke, Guillain-Barre syndrome, headache and Dizziness

6. Renal: Acute kidney injury, proteinuria and haematuria

7. Hepatic: Elevated transaminases and bilirubin

8. GI Tract: Diarrhea, vomiting, anorexia and abdominal pain

TREATMENT

1. Drugs are preventing the entrance of the Virus into the Cell: Hydroxychloroquine (HCQ), convalescent Plasma (preventing spike protein from binding to ACE2 receptor of alveolus).

   Hydroxychloroquine (HCQ) may be considered for any of those having high risk features for severe disease (such as age> 60 years; Hypertension, diabetes, chronic lung/kidney/ liver disease, Cerebrovascular disease and obesity) under strict medical supervision to avoid any serious adverse effects. Avoid HCQ in patients with underlying cardiac disease, history of unexplained syncope or QT prolongation (> 480 ms). Tab. HCQ 400 mg BD on day 1 then 200 mg BD for 5 days. In patients with a pre-existing cardiac condition, HCQ may increase the mortality rate[36]

   Convalescent plasma obtained from patients recovered from COVID-19 may be considered in patients with moderate disease who are not improving (oxygen requirement is progressively increasing) despite the use of steroids. Special prerequisites while considering convalescent plasma include: ABO compatibility and cross-matching of the donor plasma, neutralizing titre of donor plasma should be above the specific threshold (if the latter is not available, plasma IgG titre, the recipient should be closely monitored for several hours post-transfusion for any transfusion. The use of convalescent plasma should be avoided in patients with IgA deficiency or immunoglobulin allergy. The indication for convalescent plasma are patient more than eighteen years of age, a patient having hypoxia with signs of pneumonia (X-ray findings) or patients with a respiratory rate more than twenty-four per minute, oxygen saturation less than 93% on room air. The convalescent plasma should not be given to pregnant women. Dose is variable ranging from 4 to 13 ml/kg (usually 200 ml each day for two consecutive days given slowly over not less than 2 hours - total 400 ml)[36].

2. Viral load reduction: Remdesivir, Azithromycin (inhibited replication). Remdesivir may be considered in patients with moderate disease (those on oxygen). Patients with AST/ALT> 5 times the upper limit severe renal impairment, pregnancy or lactating mothers, children below 12 years of age are contraindications for the use of remdesivir. Dose: 200 mg IV on day 1 followed by 100 mg IV daily for 4 days (total 5 days)[36]

   Azithromycin in a dose of 500mg day1 followed by 250mg 2-5 days either alone or in combination with hydroxychloroquine was tried in a small prospective study. However, there was no conclusive evidence that azithromycin either alone or in with HCQ can be beneficial in COVID-19 patients. Further, the chances of cardiac arrhythmias are increased by this combination as each drug can prolong the QT interval. Periodic ECG monitoring is very important to prevent life-threatening cardiac arrhythmias in patient receiving HCQ or azithromycin[36]

3. Reduce Hyper Immune Response compounding hypoxia: (Glucocorticoids, Tocilizumab (IL-6 Inhibitor))

   Glucocorticoids can be used for a short period of time (3 to 5 days) for patients with progressive deterioration of oxygenation indicators, rapid worsening on imaging and excessive activation of the body's inflammatory response, with recommended that dose should not exceed the equivalent of Methylprednisolone 1-2mg/kg/day or Dexamethasone 0.2-0.4mg/kg/day. A larger dose of glucocorticoid will delay the removal of coronavirus due to immunosuppressive effects.

   Tilizumab may be considered in patients with moderate disease with progressively increasing oxygen requirements and mechanically ventilated patients not improving despite the use of steroids. Long-term safety data in COVID 19 remains largely unknown. The indications are patient admitted in ICU, a patient having evidence of cytokine storm (increased Serum Ferritin level, CRP level more than 20 or IL 6 level more than 3-fold rise), rising of oxygen requirement more than 6 ltrs. per minute to maintain SaO2 more than 90%, sepsis, multi organ failure and immune compromised state. Dose: 5-6 mg/kg IV (400 mg maximum) to be given in 100 ml normal saline over 1 hour, 2 doses, 24 hours apart[37].

4. Favipiravir: There are evidences for the use of favipiravir (FPV) in COVID-19. In an open-label before-after controlled study, FPV showed better therapeutic responses on COVID-19 in terms of disease progression and viral clearance. These results provide useful information of treatments for SARS-CoV-2 infection [38].

   In another study, Chen et al carried out a prospective multicentre open labelled randomised superiority clinical trial of Favipiravir (116 patients) vs Umifenovir (120 patients) for Covid-19[39]. Patients with moderate Covid-19 infections (who had not received any prior antivirals), FPV showed superior efficacy in terms of the rate of clinical recovery at day 7 and a reduced the incidence of fever and cough. The clinical recovery rate at day 7 was 55.8% in the Umifenovir group and 71.4% in the Favipiravir group. The dose of Favipiravir used was 1600mg twice daily on day 1 and then 600mg twice daily for a further seven to ten days. On August 10, 2020, FDA Clears Favipiravir for COVID-19 Facility Outbreak Prevention Study [40].

MATCHING THE DRUG AND THE PHASE OF ILLNESS

I Early infection: Symptomatic, HCQ, Ivermectine, Azithromycin.

II Pulmonary: Early and Late: Corticosteroids (Dexamethasone/Methylprednisolone), Enoxaparin, Remdesivir, Vitamin C

III Hyperinflammation phase: Corticosteroids (Dexamethasone/Methylprednisolone), Enoxaparin (Anticoagulant Heparin), Vitamin C

PREVENTION

A) Preventing exposure: Social distancing (2 meters), wearing mask, frequent hand wash and use of hand sanitizers.

B) Vaccines: Exposure of the human body to a safe fraction of a virion resulting in antibodies that will stop the virus and remember it so that can prevent the real virus during exposure to infection. Antigen-presenting cells bind the safe version of the virus injected present it to the T helper cells and B cells which in turn harvest antibodies that could fix to the real virus if confronted later. This is facilitated by some of the B and T helper cells and turn into memory cells that pile the commands so that they can rapidly trigger B and T cells into fighting through an infection. Many pharmaceutical companies have entered the fray.

CONCLUSION

The onslaught of the Covid-19, which came as an unsolicited new year gift, has become a major health scourge. Its impact on the health of the people and economy has been devastating. There being no simple cure, the emphasis on prevention is most relevant. The mortality has reduced mainly due to our better understanding of the consequences of viral infection. The increasing mortality among the frontline doctors is a cause for concern. The safer option of prevention is facilitated by safe social distancing, use of masks, frequent hand washing and use of sanitizers. It is difficult to predict how and when this nightmare would end and whether it would end at all. If indeed, it ends whether it will be by the development of herd immunity or by a successful vaccine is anybody's guess. Let us hope and pray for an early end of the COVID saga and the returning of life back to normal like the Pre-COVID days.

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CONFLICT OF INTEREST

There are no conflicts of interest to declare by any of the authors of this study

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