

# An Insight Into an Era of New Pandemic Novel Coronavirus Sars CoV-2: COVID-19

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## Abstract

*Coronaviruses typically affect the respiratory tracts mammals including birds, as well as humans. Doctors associate them with the pneumonia, bronchitis, severe acute respiratory syndrome (SARS) and COVID-19. They can also affect the gut. These viruses typically cause common colds more than any of the other serious diseases. Though, coronaviruses now have been behind some more severe outbreaks. During the last 70 years, scientists have found that these viruses can infect cats, mice, rats, dogs, cattle and horses. So, these animals have the capacity to transmit coronaviruses to humans. Most recently, this has been found a new coronavirus outbreak in China that has reached and is now progressing to other countries. It is worldwide known with the name coronavirus disease 2019, or COVID-19 by WHO (previously known as “2019 novel coronavirus”). In this article, diverse types of human coronaviruses, its symptoms, and how it gets transmitted to other people with different modalities which are being used for treatment has been explained.*

**Keywords:** Epidemic; Pandemic; COVID19; SARS; CoV; MERS; Coronavirus

## 1. Abbreviation

- SARS- Severe Acute Respiratory Syndrome
- MERS- Middle East Respiratory Syndrome
- CoV – Coronavirus
- COVID – Coronavirus Disease
- RNA- Ribonucleic Acid
- OD – Once a day

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- BD- Twice a day
- HTN- Hypertension
- DM- Diabetes Mellitus
- CKD- Chronic Kidney Disease
- PPE- Personal Protective Equipment
- SOB- Shortness of Breath

## 2. Background: What is Coronavirus?

The name “coronavirus” comes from the crown-like projections on their surfaces. “Corona” in Latin means “halo” or “crown” [1].

Researchers isolated coronavirus initially in 1937. They found that coronavirus is an infectious bronchitis virus in birds that was so severe that it can lead to shatter poultry stocks. First evidence of human coronaviruses (HCoV) was found in 1960 in the noses of humans causing common cold. Various types of common human coronaviruses are OC43, 229E, HKU1 and NL63 [1], which usually cause mild to moderate upper-respiratory tract illnesses, like the common cold. Most people (approx. 80%) get infected with one or more of these viruses during their lifetime. This information should not be confused with COVID-19 [2].

The three deadly human respiratory coronaviruses viruses so far:

- Severe acute respiratory syndrome coronavirus [SARS-CoV]
- Middle East respiratory syndrome coronavirus [MERS-CoV]
- 2019-nCoV: The virus is approximately 75 to 80% similar to the SARS-CoV

According to literature, amid humans, coronavirus infections most likely to occur during the winters and early spring. People frequently become ill with a cold owed to a coronavirus and may latch the similar one about 4 months later. This is due to fact that coronavirus antibodies do not last for a longer time. Also, the antibodies for one strain or type of coronavirus may be futile against another one.

### 2.1 Pathogenesis

After the virus enters the body, it needs a special receptor to help it enter the cell. This receptor is called (Angiotensin Converting Enzymes 2) Symbolized by ACE 2 [3].

The ACE 2 is present on the surface of the alveolar cells in the lung.

We have 3 types of alveolar cells:

- Type1: Responsible for gas exchange.
- Type2: It is responsible for producing "surfactant" which is a mixture of proteins and fats that reduce the surface tension of the alveoli.
- Type3: Dust cell, which is macrophages.

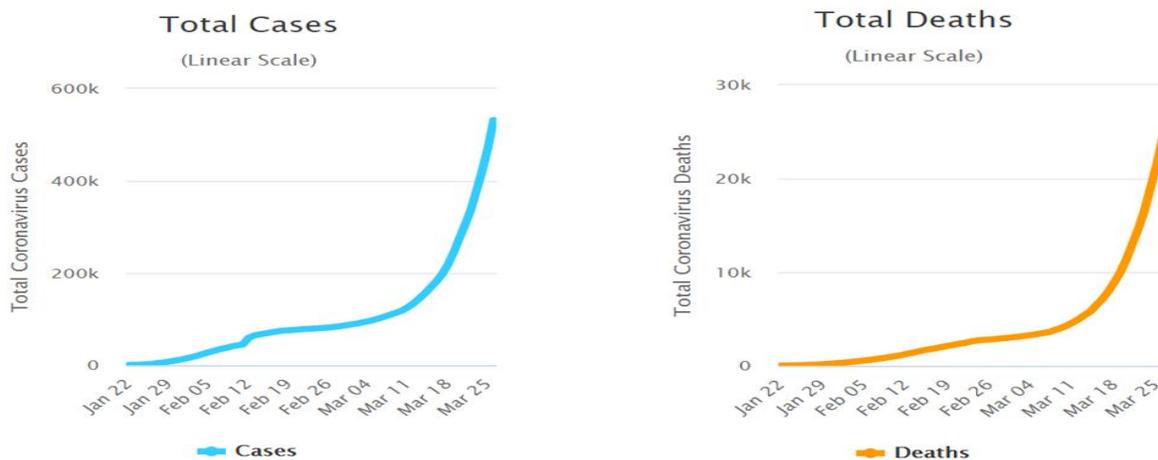
The ACE 2 is found on type2 of these cells. Corona virus envelope contains proteins called spikes and special (S-Spike) that help the virus bind to ACE 2 [3]. When the above association occurs, the genetic material of the virus enters the cell and the cell is harnessed to produce viral proteins, thus the virus multiplies and the cell dies. When (type 2 alveolar cells) die, they release substances called specific inflammatory mediators. These substances stimulate the existing immune cells "macrophages" and when they stimulate the macrophages, they secrete 3 immune substances called "cytokines" which are:

- Interleukin 1 (IL1)
- Interleukin6 (IL6)
- Tumor Necrosis Factor (TNF $\alpha$ ).

These three substances, when they reach the bloodstream, cause the symptoms associated with infection with Corona virus [4].

## 2.2 COVID-19

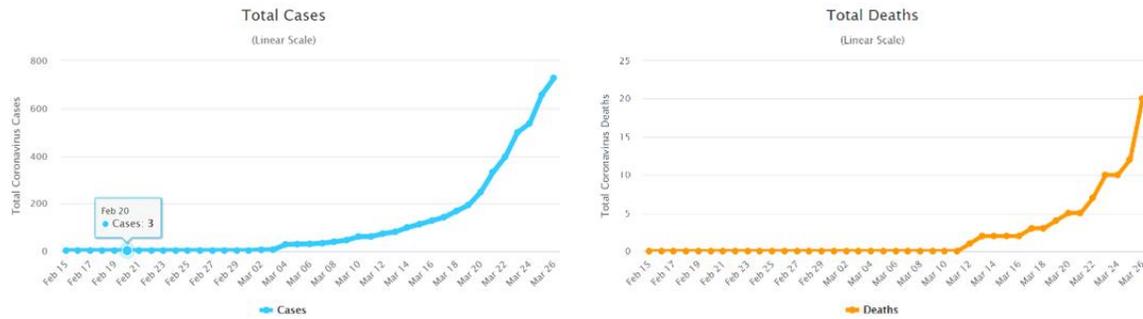
Recently in 2020, the Centres for Disease Control and Prevention (CDC) started observing and monitoring the outbreak of a new human coronavirus, SARS-CoV-2, which affects the lungs and causes the respiratory illness now famous as COVID-19 [3]. First identified in Wuhan, China. Subsequently, the virus has reached to other countries, both in and outside Asia, bounding the World Health Organization (WHO) to declare this as a pandemic [3].



**Fig. 1.** Shows total SARS CoV-2 cases and deaths all over the world as of 25th March 2020 [5].

As of March 27, more than 589,312 people have contracted the virus worldwide, causing over 26,935 deaths as shown in Fig. 1 [5]. In India, the virus has affected over 887 people, with 791 active cases, 76 recovered and 20 deaths till now as shown in Fig. 2 [6].

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**Fig. 2.** Shows total SARS CoV-2 cases and deaths in India as of 26<sup>th</sup> March 2020 [7].

The first person with COVID-19 had relations to an animal and seafood market. This suggested that animals primarily transmit the virus to humans. Conversely, people with a more recent diagnosis had no links with or revelation to the market, confirming that virus can be passed from one human to other [3].

### 2.3 Transmission

- Droplet transmission [3]
- Touching any surface or object that might have the virus and then touching mouth, nose, or possibly their eyes [3]
- Virus may also be present in feces and could contaminate places like toilet bowls and bathroom sinks [3].
- Placental transmission [4]

### 3. Clinical presentation

- Incubation period (2 to 14 days) [3]
- Severity (according to director general WHO – COVID-19) shown in Table 1 [3]

**Table: 1.** Shows Covid-19 Severity.

Stage according to Severity	Rough % of people with COVID-19
Mild disease - a person can recover	More than 80%
Severe disease, causing SOB, breathlessness and pneumonia	Around 14%
Critical disease, including respiratory failure, septic shock, and the failure of more than one organ	About 5%
Fatal disease	2-5%

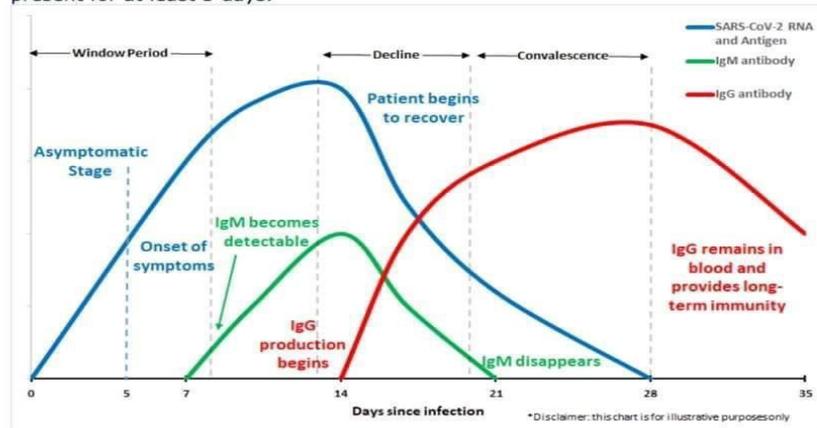
- Age affected (Middle aged people >30 years of age and Elderly)
- Clinical Presentation [7]
- Runny Nose
- Sore Throat
- Headache

- Fever
- Cough (Dry Cough)
- General Weakness (Bore Unwell)
- Gastrointestinal symptoms

#### 4. Diagnosis

- Sample - Nasopharyngeal and Oropharyngeal swab [1].
- Confirmatory Test - SARS-CoV-2 RNA is tested by polymerase chain reaction (RT-PCR) giving results in 16-18 hours. Usually second confirmed test is considered as positive for the disease [7].
- Rapid Tests - These qualitatively detects IgG and IgM antibodies to SARS-CoV-2 in human blood, serum and plasma samples collected, used for rapid screening of patients [9]. But should not be used until symptoms present for at least 3 days as it may lead to adverse effects and further false positive or negative reports.
- Serum Procalcitonin (Initially Normal but Increases in severe cases requiring further management).
- C - reactive protein (CRP) (Increases in COVID-19) [4].
- Chest Xray – Not Specific and generally is normal but can be lobar/multi-lobar/bilateral consolidation.
- Computed Tomography (CT Chest) – Pan and other coauthors described the tomographic changes of 21 patients with mild to moderate disease who recovered from the disease, and they described four stages: [11]. [Fig. 3].

Therefore, this COVID-19 Rapid Test should not be used until symptoms have been present for at least 3 days.



Test results			Clinical Significance
PCR	IgM	IgG	
+	-	-	Patient may be in the window period of infection.
+	+	-	Patient may be in the early stage of infection.
+	+	+	Patient is in the active phase of infection.
+	-	+	Patient may be in the late or recurrent stage of infection.
-	+	-	Patient may be in the early stage of infection. PCR result may be false-negative.
-	-	+	Patient may have had a past infection, and has recovered.
-	+	+	Patient may be in the recovery stage of an infection, or the PCR result may be false-negative.

**Fig. 3.** Shows RT-PCR, IgM and IgG test results with clinical Significance.

- Ear ly stage (0-4 days after the onset of the symptoms), in which ground glass opaci ties (GGO) are frequent, with sub-pleural distribution and involving predominantly the lower lobes. Some patients in this stage could have a normal CT.
- Progressive stage (5-8 days after the onset of the symptoms), the findings usually evolved to rapidly involvement of the two lungs or multi-lobe distribution with GGO, crazy-paving and consolidation of airspaces.

- Peak stage (9-13 days after the onset of the symptoms), the consolidation becomes denser and it was present in almost all of the cases. Other finding was residual parenchymal bands.
- Absorption stage (>14 days after the onset of the symptoms), no crazy paving pattern was observed, the GGO could remain.

Shi et al [11] also described the CT findings in 81 patients in Wuhan, China. All of the patients had an abnormal CT, and the features include: GGO, smooth and irregular interlobular septal thickening, crazy paving pattern, air bronchogram and irregular pleural thickening. Usually affecting the subpleural regions and the lower lobes [11].

- Lung ultrasound (USG) – Not specific
- Pulmonary function tests (PFT) – not recommended as it can be source of cross infection due to direct and close contact and also through aerosols particles

## 5. Management

Right now, the therapeutic approaches to deal with the infection are only supportive, and prevention aiming at reducing transmission in the community is the best weapon [4].

- Aggressive Isolation is the only modality to stop the spread of the infection, so preparing isolation rooms is recommended
- Usage of Personal Protective Equipment (PPE) for the doctor and staff whosoever is coming in direct contact with the patient
- Usage of Alcohol Based hand Sanitizers

## 6. Treatment

There is no specific antiviral treatment recommended for COVID-19, and no vaccine is currently available at time of writing this article. But according to The Economic Times report on March 16, 2020. A combination of two anti-HIV drugs has proved crucial in the treatment of coronavirus positive cases viz. Lopinavir 200mg and Ritonavir 50mg twice a day and doctors also gave her chloroquine (useful in the treatment of malaria) and oseltamivir (useful in swine flu treatment) [12].

According to Dr. Zev Zelenko, a doctor in New York, combined the data available from China and South Korea with the recent study published from France, has treated approximately 350 patients in Kiryas Joel and another 150 patients in other areas of New York with regime followed as Hydroxychloroquine 200mg twice a day for 5 days, Azithromycin 500mg once a day for 5 days, Zinc sulfate 220mg once a day for 5 days resulted in ZERO deaths, ZERO hospitalizations, and ZERO intubations [13]. In addition, there were no negative side effects other than approximately 10% of patients with temporary nausea and diarrhea.

A Bengaluru-based oncologist, Dr. Vishal Rao, has applied for a government review of a new concoction of drugs developed by his team, which he says could prove to be effective in treating the novel coronavirus [14]. Surgical oncologist Dr. Rao said that he had conceived of a mixture of cytokines, which when injected into coronavirus positive patients could re-activate their immune system though it is in developing stage.

According to BJMC Pune Treatment protocol for COVID-19 confirmed cases is divided into 6 groups [14]: [Table 2]

**Table 2:** BJMC Pune Treatment protocol for COVID-19.

Group A.	Asymptomatic but Positive for COVID 19	Cap. Oseltamivir 75 mg BD for 5 days + Tab. Azithromycin 500mg OD x 5 days
Group B.	Symptomatic/URTI without comorbidity 3 out of 4 <ul style="list-style-type: none"> <li>• Fever</li> <li>• Dry cough</li> <li>• Shortness of breath</li> <li>• Myalgia</li> </ul>	Cap. Oseltamivir 75 mg BD for 5 days + Tab. Azithromycin 500mg OD x 5 days + Tab. HCQ 400 mg BD on day 1 then 200 mg BD for 4 days
Group C.	Symptomatic/URTI with comorbidity <p>&gt; 60 yrs DM HTN /IHD COPD/Chronic lung disease Immunocompromised state Immunosuppressive drugs CKD</p>	Cap. Oseltamivir 75 mg BD for 5 days + Tab. Azithromycin 500mg OD x 5 days + Tab. HCQ 400 mg BD on day 1 & 200 mg BD for 4 days + Lopinavir / Ritonavir 200 mg + 50 mg 2 tab BD x 5 days
Group D.	Pneumonia (LRTI) without respiratory failure	Cap. Oseltamivir 150 mg BD for 10 days (Double dose) + Tab. Azithromycin 500mg OD x 10 days + Tab. HCQ 400 mg BD on day 1 then 200 mg BD for 9 days + Lopinavir / Ritonavir 200 mg + 50 mg 2 tab BD x 10 days
Group E.	Pneumonia (LRTI) with respiratory failure	Cap. Oseltamivir 150 mg BD for 10 days (Double dose) + Tab. Azithromycin 500mg OD x 10 days + Tab. HCQ 400 mg BD on day 1 then 200 mg BD for 9 days + Lopinavir / Ritonavir 200 mg + 50 mg 2 tab BD x 10 days
Group F.	Pneumonia (LRTI) with respiratory failure multi organ dysfunction syndrome	Cap. Oseltamivir 150 mg BD for 10 days (Double dose) + Tab. Azithromycin 500mg OD x 10

		days + Tab. HCQ 400 mg BD on day 1 then 200 mg BD for 9 days + Lopinavir / Ritonavir 200 mg + 50 mg 2 tab BD x 10 days
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- Anti-retroviral Drugs viz. Lopinavir, Ritonavir, Oseltamivir etc [12]
- Ace Inhibitors (ACEi) /Angiotensin Receptor Blockers (ARBS) - Proposed reduction of cytokine storm.<sup>5</sup>
- Interferons - Impair the antiviral adaptive type 1 T-helper cell [4]
- Chloroquine/Hydroxychloroquine - Adult Dose: 400mg PO Q12h x 1 day, 200mg PO Q12h x 4 days and Pediatric dose: 6.5mg/kg PO q12h x 1 day, then 3.25mg/kg/DOSE PO q12h x 4 days [13]
- Tocilizumab (optional) - Dose: 4-8 mg/kg (max 400mg) IV x 1. Proposed to reduce the cytokine storm [4]
- Corticosteroids - Not indicated in treating SARS CoV2 as per available evidence and it Might prolong viral shedding [11]
- Ascorbic Acid - Ascorbic acid did appear to improve mortality in the multi-center CITRIS-ALI trial but no high-quality evidence that it helps in reducing viral pneumonia [12]
- Anti-Bacterial Therapy [4]
- OTHER AGENTS: Baricitinib/Darunavir/Cobicistat, Umifenovir(Arbidol)- 200 mg TDS, Favilavir- first approved drug in china, Galidesivir, Leronlima, Brilacidin, Combination of monoclonal antibody, Traditional medicines in different countries.

### 6.1 Additional

- Patient should be classified as mild/severe/critical
- Decide either he/she requires home isolation only or special isolation.
- Consider referral to a dedicated nodal centre for SARS CoV-2 if requiring admission
- Domestic care advises in mild/asymptomatic cases

### 6.2 Blood transfusion

The COVID-19 virus is chiefly transmitted by the respiratory route and theoretically by transfusions. The epidemic has the potential and can lead to reduced supply of blood and blood components and also adversely affects blood system activities. Therefore, proper planning, assessment is required by Blood services to respond appropriately and proportionately [14].

Blood services must be prepared to move quickly in response to changes, during which blood sufficiency is most likely to be affected. A national rather than sub-national or local approach should be adopted for coherence and coordination and to ensure public confidence in blood safety and supply. Blood services should be included in the national outbreak response, through experts linked to the national emergency response team. Blood services should activate their emergency response plans. Networks of cooperating blood services across regions can help maintain the availability of blood and blood components.

Donors and potential donors should be informed of the importance of self-deferral if they are feeling unwell, and of reporting immediately to the blood service any COVID-19 related illness within 28 days after donation. If COVID-19 is confirmed in a blood donor or staff, the management of contacts should follow national public health guidelines [14,15].

Experience suggests that empirical use of convalescent plasma (CP) may be a potentially useful treatment for COVID-19. Detailed risk assessment must always be conducted to ensure that the blood service has sufficient capability to safely collect, process and store these specific blood components in a quality-assured manner. WHO has previously released interim guidance for the use of CP collected from patients recovered from Ebola Virus Disease [15]. Additionally, the WHO Blood Regulators Network Position Paper on Use of Convalescent Plasma, Serum or Immune Globulin Concentrates as an Element in Response to an Emerging Virus (2017) provides helpful considerations.

## 7. Prevention

### 7.1 Prevention from viral respiratory infections

#### 7.2 Self-Protection

- Washing hands often with soap for at least 20 seconds
- Avoiding to touch eyes, nose, or mouth with unwashed/aseptic hands
- Avoid close contact with others who are sick or symptomatic

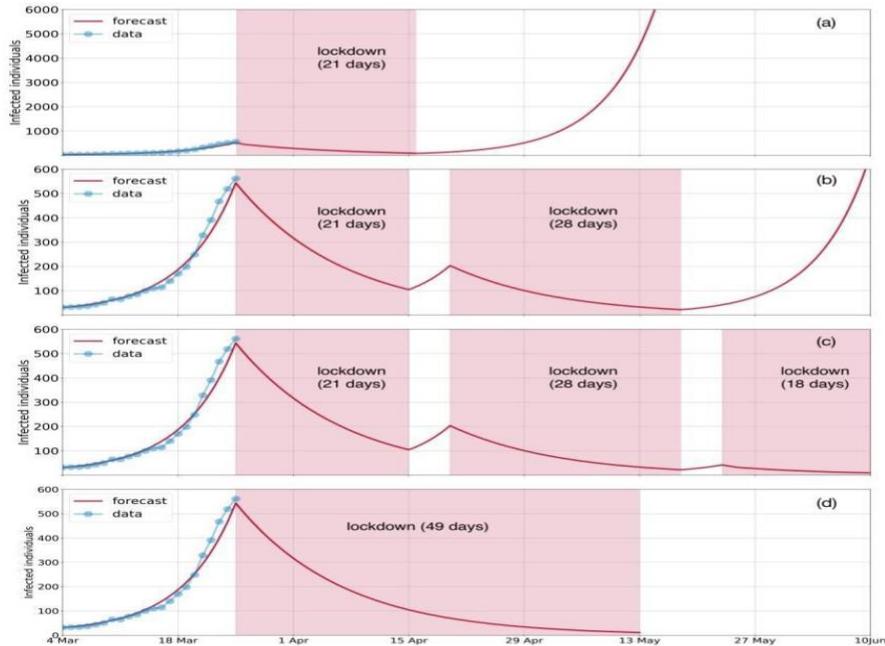
#### 7.3 Protecting others

- Stay home (Quarantine yourself) [2]
- Avoid meeting people – Social Distancing (1 meter or 3 feet) [16]
- Cover your mouth and nose with triple layer disposable surgical mask when going out whether you may/may not have any Respiratory symptoms (N95, FFP3 & FFP2 or else surgical mask) [4]
- Clean and disinfect objects and surfaces with alcohol-based Sanitizers

Intercollegiate General Surgery Guidance on COVID-19		
<b>Emergency Surgery</b> - Test all for COVID-19 - Treat all as +ve - CT thorax in last 24 hours - Add CT thorax if having CT abdo	<b>Planned Surgery</b> - Risk assessment for COVID-19 - Greater risks of surgery - Consent - Risk-reducing strategies (e.g. stoma)	<b>PPE</b> - PPE for all laparotomies - Unless COVID-19 negative (beware false negative) - Include eye protection - Practise donning & doffing
<b>Theatre</b> - Minimum staffing levels - All staff PPE including visors - Stop +ve pressure ventilation - Smoke extraction - Intubation / extubation in theatre	<b>Laparoscopy</b> - Generally should not be used - Filters etc. difficult to implement - Appendicitis: open / conserv. - Cholecystitis: conserv. / cholecystostomy	<b>Endoscopy</b> - Emergency only - Follow guidance from BSG - Upper GI endoscopy requires full PPE

Fig. 4. Surgical protocols and guidelines [17].

India Led the World Eradicting two Silent Killers – Polio and Smallpox: Fate of COVID-19?



**Fig. 5.** Forecast of COVID-19 epidemic in India with mitigatory social distancing.

**8. Vaccines (in Developing Stage)**

- Altimmune’s intranasal coronavirus vaccine [4]
- INO-4800 by Inovio Pharmaceuticals
- mRNA-1273 vaccine by Moderna [7]
- Avian Corona virus Infectious Bronchitis Virus (IBV) vaccine by MIGAL and many more [7]

**9. Is SARS CoV-2 a Bio-Weapon?**

Descriptions of the use of microbial pathogens as potential weapons of war or terrorism date from ancient times. Viz. Tularemia Cause by infected rams sent by Hittites in fourteenth Century B.C, water supply poisoning in the sixth century B.C. with the fungus *Claviceps purpurea* (rye ergot) by the Assyrians etc [20].

The U.S. Centers for Disease Control and Prevention (CDC) has classified potential biologic terrorisations into three categories: A, B, and C.

**Category A** agents are the highest priority pathogens – examples Anthrax, Botulism, Plague etc.

- Disseminated or transmitted from person to person
- High mortality rates
- Cause public panic and social disruption

**Category B** agents are the 2<sup>nd</sup> highest priority pathogens and include those that are moderately easy to disseminate, result in moderate morbidity rates and low mortality rates, and require specifically enhanced diagnostic capacity. Examples Brucellosis, Glanders, Typhus Fever, Viral Encephalitis etc [20].

**Category C** agents are at the 3<sup>rd</sup> highest priority. These embrace certain emerging pathogens to which lead to lack of immunity in general population; that possibly would be engineered for mass propagation in the future because of availability, ease of production, and ease of dissemination; and that have a major public health impact and the potential for high morbidity and mortality rates. Examples emerging infections like Nipah, SARS or MERS Coronavirus, Hantavirus and Influenza [20].

Although the prospect of a deliberate attack on civilians with disease-producing agents may seem to be an act of incomprehensible evil, history shows us that it is something that has been done in the past and will likely be done again in the future. It is the responsibility of health care providers to be aware of this possibility, to be able to recognize early signs of a potential bioterrorist attack and alert the public health system, and to respond quickly to provide care to the individual patient [20].

## 10. Management of Dead Body: COVID-19

All staff identified to handle dead bodies in the isolation area, mortuary, ambulance and those workers in the crematorium / burial ground should be trained in the infection prevention control practices [15-17].

### 10.1 Removal of body from isolation room/area

Proper hand hygiene should be performed, also ensure use of PPE. Any wound or puncture holes (ensuing from removal of drains, catheters, or otherwise) must be disinfected with 1 percent hypochlorite and to be dressed with impermeable material [21]. Leak-proof plastic body bags should be used to cover the dead body. 1% hypochlorite is used on the exterior of the body bag to decontaminate. Equipment once used should be washed, decontaminated and autoclaved with disinfectant solutions. All medical waste must be handled and disposed of in accordance with biomedical waste management rules.

### 10.2 Environmental cleaning and disinfection

All surfaces of the isolation area (bed, floors, side tables, railings etc.) should be cleaned with 1% Sodium Hypochlorite (NaOCl) solution; allow it to stand for 30 minutes, and then allowed to dry with air [18,21].

### 10.3 Handling of dead body in Mortuary

Mortuary staff supervising COVID dead body should follow standard precautions. Cold chambers should be used to store dead bodies maintained at approximately 4°C [21]. The mortuary must be kept clean. Instruments, transport trolleys and environmental surfaces should be disinfected with 1% Hypochlorite solution [21]. All other surfaces should be disinfected and cleaned with 1 % NaOCl [21].

#### 10.4 Autopsies

Autopsies are generally avoided. If autopsy is to be performed for exceptional reasons, standard precautions to be followed [21].

#### 10.5 At crematorium/burial ground

The Crematorium/ burial Ground staff should be sensitized that COVID 19 does not pose additional risk, so standard routine procedure to be followed [21].

### 11. Conclusion

Corona virus disease 2019 was first reported as cluster of disease in China in December 2019. Elderly persons with co-morbidities are more affected sharing almost equal distribution with infants.

Mainly spread via Respiratory droplets. Respiratory Infection/ SOB/ Difficulty in Breathing are the most common complications. Mortality rate is approximately 2.3 to 5%. Presently there is no standardized treatment or vaccine available, so our recommendations would be for containment and prevention by social distancing and lockdown at this point of time, further research, and clinical trials is the need of the hour to come up with a vaccine or drugs to halt this global pandemic COVID-19.

### 12. Declarations

- Ethics approval and consent to participate – Not Applicable
- Consent for Publication – Not Applicable
- Competing interests – No Conflicts of Interest
- Funding – Not Applicable

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