Introduction

Novel Coronavirus (SARS-CoV-2) was first reported from Wuhan, China from where it has spread globally.[1] The SARS-CoV-2 strain has genetic correlation with SARS-CoV that resulted in a global epidemic affecting more than twenty-five nations with total deaths at 8096 cases. The World Health Organization (WHO) declared this as a pandemic with significant mortality and morbidity. Symptoms of illness from SARS-CoV-2 transmission begin only days after its transmission and has moderate amount of viral load within respiratory tract fluid/secretions very early in the disease with peak load approximately ten days following symptoms’ development. Zou et al. (2020) studied SARS-CoV-2 viral load in specimens belonging to upper respiratory tract of 18 patients belonging to Zhuhai, China using reverse-transcriptase polymerase chain reaction assay which targeted the N and Orf16 genes of SARS-CoV-2. 17 subjects who had turned symptomatic showed higher load of the virus from nasal when compared with throat swabs from the same patients. This study provided evidence that the pattern of viral shedding for SARS-CoV-2 resembles that of influenza but is different from SARS-CoV. Thus, more data is required for determining and fully understanding the disease dynamics. It was shown in this study that viral transmission can take place in early stages of disease.[2] The most important factor in spread of this disease is its severity of spread as a single spill-over event (SARC-CoV) or via crossing of species barrier.[3]

An epidemic turns into a pandemic when a widespread geographical disease distribution occurs. After H1N1 pandemic in 2009, Morens et al. defined criteria for a pandemic which included: 1) New virus which has not been discovered previously; 2) Coronavirus: An emergency for healthcare professionals

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ABSTRACT

Coronavirus infection is a transmissible disease. It was first described in China in December, 2019. It has been said to have a person-to-person transmission after prolonged and unprotected exposure. Patients with a potential SARS-CoV-2 exposure present with symptoms of low-grade pyrexia, dry cough, or shortness of breath. People with these symptoms should contact health-care providers before seeking medical intervention so that appropriate preventive actions may be implemented. Health-care facilities should rapidly isolate suspected individuals and notify local health departments for support involved in performing laboratory tests and efforts in containment. The present article describes the nature of virus, method of detection, and its mode of transmission.

Keywords: Health-care, novel coronavirus, SARS-CoV-2, symptoms, transmission
2) Widespread geographical distribution; 3) Human to human spread; and 4) Explosive outbreak.[4]

Initially, all of the cases detected in countries other than China were linked to infected cases from China, with subsequent generation of cases in some of the countries, the latest being Japan, South Korea, and Italy. Considering the high population mobility through air travel and the documented person-to-person transmission, the WHO provided an advisory on exit screening in countries with the ongoing transmission of COVID-19 and entry screening in countries without transmission, including screening for the signs and symptoms of respiratory infection with focus on temperature screening to detect potential suspects who would require further laboratory tests for the confirmation of infection. India ranks 17th among the countries at the highest risk of importation of COVID-19 through air travel. The probability of an infected air traveler to come to India as the final destination was 0.209%, with the highest relative import risk in Delhi (0.064%) followed by Mumbai, Kolkata, Bengaluru, Chennai, Hyderabad, and Kochi. This in the context of an epidemic that has already set in and travel from infected areas continues.[5]

Viral Structure and Composition

Coronaviruses are structurally enveloped RNA viral particles responsible for causation of respiratory, hepatic, enteric, and neurological disorders. There are six species of this strain which are known to cause pathologies among humans. Four of these are prevalent forms, namely, OC43, HKU1, NL63, and 229E. These strains are responsible for symptoms of common cold in immunocompetent subjects. Remaining two strains, Middle East Respiratory Syndrome Coronavirus (MERS-CoV) and Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV), have a zoonotic origin and can sometimes result in fatality. Phylogenetic analysis of bronchoalveolar lavage samples showed that this virus comes under the genus “Betacoronavirus.” This gene includes SARS-CoV and bat SARS-like CoV. High throughput sequencing is a useful tool for identifying such pathogens. This study utilized propagation of viral strains on human airway epithelial cell cultures, transmission electron microscope, and whole-genome sequencing for identification.[6] Complications associated with novel coronavirus infection include respiratory failure, cardiac damage/injury, acute respiratory distress syndrome (ARDS), and severe pneumonia.[7]

Two types of coronavirus strains bind to epithelial cells using similar receptor, ACE2. These are NL63 and SARS-CoV. NL63 causes mild form of upper respiratory tract disease while SARS-CoV results in severe disease of lower respiratory tract with approximately 11% fatality. The chain of infection transmission is difficult to identify when subjects are having mild symptoms or asymptomatic. Viruses are effectively controlled through surveillance of symptoms and tracing of contacts as proven by SARS-CoV and Ebola virus.[8]

Earliest patients of pulmonary infection were identified by surveillance of “pneumonia of unknown etiology” mechanism. It is definable as a disease with no pathogen. It is identified using the following criteria: fever (more than 38°C), radiological evidence of pneumonia, normal or low white blood cell or lymphocyte count, and absence of improvement in symptoms following anti-microbial therapy for the duration of 3 to 5 days. One of the prominent features of MERS and SARS outbreak is its heterogeneous nature of transmission and super-spreading episodes/events.[9]

Methods of Testing

The 2019-nCOV is tested using real-time reverse transcription-polymerase chain reaction (RT-PCR) assay from throat swab samples.[9] Han et al. in their study found that sputum testing provides more sensitive results than throat swabs for testing COVID-19. It has been suggested that induced sputum in patients who have been clinically cured and test repeatedly negative for throat swabbing should be tested with induced sputum testing for COVID-19 as more reliable testing criteria.[10]

Studies on Transmission of nCOVID-19 OR SARS-CoV-2

Most of the major epidemic spread has occurred due to crowding, sanitary inadequacies, and public movement. In 1968, influenza was the first pandemic which was spread by air travelers followed closely by acute enterovirus hemorrhagic conjunctivitis.[11]

Spread in dental settings

Spread via aerosol and droplets

NCOVID19 transmission via droplets and aerosol generation are of importance in dental clinics and teaching hospitals due to their admixture with patient saliva and blood during dental procedures. Use of high-speed dental handpieces operated at high speed along with running water produces aerosol droplets mixed along with patient’s saliva and blood. Small particles of droplets and aerosols remain air-borne for a large period of time before settling over any surface or entering respiratory tract. Hence, 2019-nCoV can have a potential of spreading from infected patients in dental operatories.

Transmission via contaminated surfaces

Droplet contact with conjunctival, nasal, or oral mucosa can also take place. Contaminated surfaces have frequent contact with health-care professionals.

Yadav et al. reported three cases with a travel history from Wuhan, China that were confirmed positive for SARS-CoV-2. Phylogenetic analysis, molecular characterization, and prediction of B- and T-cell epitopes for Indian SARS-CoV-2 sequences were undertaken. Indian SARS-CoV-2 sequences showed two
changes 408 Arg → Ile and 930 Ala → Val in the spike protein compared to the Wuhan Hu-1 sequence.\[12\]

Phan et al. first reported 2019-nCoV transmission from father to son (i.e., human to human transmission) in China. This family travelled across four cities in Vietnam using various transportation methods. Thus, this was the first instance where cross-infection was identified.\[13\] Liu et al. reported the first transmission to Taiwan from a couple. The wife had a travel history from China. Her husband contracted the disease from her. This was the first case of local transmission but from which no secondary infection has been identified.\[14\]

Pongpirul et al. reported human to human transmission from Chinese tourists to a Thai taxi driver who initially developed a low-grade fever at 98 degree Fahrenheit, fever, myalgia, and cough. He tried self-medication using over-the-counter drugs at first but due to lack of relief in symptoms, he reported to a private primary clinic in Bangkok. There throat swabs were taken for testing of Influenza A and B. Medications did not relieve his symptoms and the test turned out to be negative. Later, he reported to a public hospital with fever and had also developed mild dyspnea. Chest radiographs were taken which showed patchy and reticular lower lung infiltration. Here, throat and nasopharyngeal swabs were taken which tested SARS-CoV-2 positive using real-time reverse transcriptase polymerase chain reaction (RT-PCR). However, RT-PCR assay performed on ten close contacts were negative thus, excluding any further transmission.\[13\]

Liu et al. reported COVID-19 infection in children presenting as moderate-to-severe respiratory distress in the initial or early stage of the disease during the epidemic in Wuhan.\[14\]

Holshue et al. reported the first case of 2019 novel coronavirus in United States. The patient reported with dry cough and two-day history of nausea along with vomiting. There was no dyspnea or any pain in chest. The subject developed fever of intermittent variety along with tachycardiac episodes. In addition, there was the presence of nonproductive cough and fatigue. On the sixth day of hospitalization, chest radiograph exhibited streaks of basilar opacities bilaterally which was consistent with atypical pneumonia. The patient tested consistently positive for 2019-nCoV RNA. Patient was treated with intravenous administration of Remdesivir alongside Vancomycin and Cefepime. On the eighth day, the subject’s clinical condition improved.\[14\]

Guan et al. in their study on 67 patients found following symptoms: a) Pyrexia (43.8% at time of hospital admission and in 88.7% cases while being hospitalized), b) cough (in 67.8% cases), and c) diarrhea (3.8% cases). The median time for incubation of the virus was found to be four days. At the time of admitting the patient, the most frequent radiological feature was of ground glass opacification in computed tomography of chest along with patchy shadows bilaterally in 51.8% cases admitted. 83.2% cases presented with lymphocytopenia; 36.2% and 33.7% cases were diagnosed with thrombocytopenia and leucopenia, respectively. SARS-CoV-2 was detectable in gastrointestinal tract, urine, and salivary secretions.\[15\]

There is uncertainty regarding the possible time of viral transmission by the subclinically affected or asymptomatic patients. A quarantine period of 14 days is considered for the screening incubation period of SARS-CoV-2. Currently reported symptoms of infection include fatigue, low-grade fever, soreness in throat, cough, rhinorrhea, myalgia, diarrhea, and dyspnea. Hoehl et al. in their study found that symptom-based screening is ineffective in SARS-CoV-2 infection detection. The investigators reported that shedding of this strain can occur in subjects who are asymptomatic or show mild symptoms.\[16\] Covid-19 shows 1% risk of fatality due to its exponential increase in rate.\[16\]

Pung et al. analyzed three COVID-19 clusters of Singapore for assessing interaction types and transmission modes. They showed that SARS-CoV-2 can be transmitted through community spread via households, thus, containment of such locally transmitted clusters.\[21\]

Few of endemic malaria-affected African areas have reported COVID-19 positive cases from Senegal, Nigeria and Congo Republic. It has been transmitted through inhalation of respiratory droplets and direct human-to-human contact.\[22\]

The most important challenge in tackling of this virus is time and duration of overall shedding of the virus. The RT-PCR can detect any SARS-CoV-2 RNA which might not be infectious in nature. Thus, more focused testing methods are required for its detection. Ghirardi et al. in their study detected household transmission following frequent and prolonged interaction period with index subject (patient). Also, challenging is the fact that detection of new symptoms.
Coronavirus disease 2019 (COVID-19) outbreak, which is caused by the “severe acute respiratory syndrome coronavirus 2” (SARS-CoV-2), has spread at a very fast rate from China to rest of the world. As a precautionary measure, all governments along with medical fraternity are taking essential steps for prevention of its transmission which includes drastic quarantine. At this hour, screening of human cells, tissues, or cellular or tissue-based products and their donors is also being considered important as these sources have the potential of COVID-19 transmission. Thus, various institutions have recommended interim precautions for screening of all new donors. Following this, the US Food and Drug Administration (US-FDA) has suggested a donor's history of travel in areas with corona outbreak, any history of cohabitation with infected patients, and/or diagnosis or suspicion of COVID-19 within 28-day duration before obtaining donor’s tissue. As the COVID-19 outbreak has a rapid spread, National Transplant Centre has taken strong steps and has recommended testing of all potential tissue as well as stem-cell living along with donors who are dead using the real-time RT-PCR assays of nasopharyngeal swab samples or of broncho-alveolar lavage obtained from deceased subjects.[24]

Fecal microbiota transplantation is a new treatment method which has rapidly earned a major role in the management of recurrent Clostridioides difficile infection due to its clear advantages over antibiotics use. The risk SARS-CoV-2 transmission by means of fecal microbiota transplantation might be greater than other tissue transplants. There is evidence that SARS-CoV-2 can be traced in fecal samples. Stool samples can remain positive for the virus long after it is undetectable in respiratory tract, suggesting that there is a possibility of fecal-oral transmission route. This hypothesis can be supported by gastrointestinal symptoms subjects who are affected by COVID-19. Other issue is that fecal microbiota transplantation classified variously worldwide, with few countries regulating these transplants as drug (for example, US, UK, and France) or as a tissue (for example, Italy), while few nations have no specific regulations (for example, Australia). This can result in contribution to further infection spread. Thus, in countries with endemic disease, Reverse Transcriptase-PCR assay should be performed on all donors, even if asymptomatic nature or absence of a history of travel to a high-risk country or contact with an infected subject. Donor stool samples can be stored and quarantined for the duration of 30 days and used when the donor has not developed any symptoms. Stool banks should also do a retrospective checking of the overall health status of donor before using frozen feces samples in order to avoid further spread of SARS-CoV-2.[23]

Telemedicine in Coronavirus Epidemic/Pandemic

Use of electronic intensive care units (e-ICU) monitor continuously feed programming which allows health care practitioners to remote monitoring of sick patients. Mobile-integrated health care programs can help in treating patients from home. Availability of mobile health care unit directly to homes may help in the coordination of home-based tests. These methods can effectively reduce the numbers of infections among health-care workers. In addition, online and remote modules for training sessions can acquainte clinicians as well as patients for emergency training or assistance, respectively.[25]

Epidemiological and surveillance-based activities help us to choose methods of controlling an epidemic spread and avoid interventions which may not be cost-effective or restrict normal activities. Types of incidences required for epidemic control include: mild symptomatic (studied through syndrome surveillance and targeted virus testing); risk factors and transmission period (studies conducted on households); rate of attack and disease severity (community-based studies); studying pyramid of severity (study involving integration of sources and data); case-control studies for analyzing risk factors associated with infection and mortality; and studies of viral shedding by evaluating time and intensity of transmission.[26,27] Further epidemiological analysis is required to establish modes of transmission, intervals in viral reproduction, and clinical disease spectrum for prevention, control, and eradication of 2019-nCoV.

Implications for Clinical Practice

The greatest risk in COVID-19 is transmission to healthcare workers. During the past month, huge progress has been made in pathogen monitoring, identifying sources, basic etiology, clinical treatment, drug testing, and vaccine development. With the efforts of China and the help of other countries in the world, we hope that the epidemic will subside soon. Future research on viral replication, pathogenesis, antiviral drugs, and other aspects of 2019-nCoV will contribute to the treatment and prevention of the virus.[28]

Healthcare professionals must be educated regarding the modes of spread of 2019-nCoV, how to identify patients with 2019-nCoV infection, and what extra-protective measures should be adopted during the practice, in order to prevent the transmission of 2019-nCoV. Here, we recommend the infection control measures that should be followed by healthcare professionals, particularly considering the fact that aerosols and droplets were considered as the main spread routes of 2019-nCoV. Isolation of confirmed or suspected cases with mild illness at home is recommended. The ventilation at home should be good with sunlight to allow for the destruction of virus. Patients should be asked to wear a simple surgical mask and practice cough hygiene. Caregivers should be asked to wear a surgical mask when in the same room with patient and use hand hygiene every 15–20 min.[29,30]

Conclusion

Recognition of an epidemic by general public occurs in three stages. The first stage is influenced by the reassurance of self or protecting economic interests. Largely the population ignores public-ignored clues of an epidemic. The second stage is driven by public demands and explanations which can be both moral as well as mechanical in nature. However, the third stage involves epidemic spread. A similar phenomenon can be observed in the current COVID-19 spread all over the world. Usually quarantine fails to contain the pathogen such as SARS-CoV-2 and Influenza
The spread of nCovid-19 has severe economic implications on middle and low-income nations. Viral genome sequencing is complete and vaccines are in process of preparedness. Furthermore, manufacturing of constructs which are based upon viral nucleic acids is a major technical challenge which when overcome can solve this viral pandemic. Funding by governments in pandemic-related investments helps in minimizing risk for pharmaceutical agencies and companies. Establishment of vaccine manufacturing facilities can generate supply of vaccines in a short span of time.

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Conflicts of interest
There are no conflicts of interest.

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