



Pathogenesis, Diagnosis, Treatment and Prevention Strategies of Human Coronavirus: A Review

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Abstract

Coronaviruses is a group of virus which infects many species of animals, including humans. The rapid outbreak of COVID-19 raised serious attention at national and international levels and it was recognized as a pandemic by the World Health Organization. The disease model comprised of three different phases: replication of virus, hyperactivity of immune system and pulmonary cells destruction. For the diagnosis of asymptomatic carriers, viral nucleic acid (RNA) can be detected by using pharyngeal swab. Isolation of infected persons prevents the transmission and spread risk of the disease. Therapy includes use of oxygen therapy, high-flow nasal cannula (HFNC) and methylprednisolone (IV) and in severe cases adrenaline (IV). Anti-viral drugs such as ritonavir plus lopinavir per-orally and antibiotics (moxifloxacin or any antibiotic) were administered by IM/IV route to prevent secondary bacterial infection. Education campaigns are launched to promote different precautionary measures to avoid disease transmission. [*Bangladesh Journal of Infectious Diseases, October 2020;7(suppl_2):S34-S37*]

Keywords: Covid-19; SARS-CoV-2; Coronavirus; respiratory distress

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Introduction

Coronaviruses is a group of virus which infects many animal species and humans. The isolation of coronavirus strain from murine (JHM strain), was first reported¹⁻². The name “coronavirus,” was derived from “corona” or crown like morphological

feature observed under electron microscope³. Although common cold and flu is symptom of human coronaviruses. However, in 2003, when it became apparent that a new coronavirus caused severe acute respiratory syndrome (SARS) in humans, coronaviruses became much more recognized.

Molecular structure of SARS CoV2

Coronaviruses are positively stranded RNA (approximately 30 kb), enveloped viruses with round virion having 80 to 120 nm diameter⁴⁻⁵. The genome RNA of virus is complexed having helical nucleocapsid in viral membrane. Three viral proteins are recognized in the membrane of corona viruses. These are type I glycoprotein spike (S), having peplomers on surface of virion, giving it crown like (corona) morphological feature under electron microscope; membrane protein (M) having a short N-terminal ecto-domain and cytoplasmic tail which spans the membrane thrice; and small highly hydrophobic membrane protein (E)⁶. Zoonotic spillover was due to modifications at spikes level on receptor binding sites. In December 2019, Wuhan city of China became the center of pneumonia epidemic of unknown reason. By January 2020, the novel virus was isolated by Chinese scientists named it as covid-19. This rapid outbreak raised serious attention at national and international levels and within weeks, it was recognized as a pandemic by the World Health Organization, crossing Wuhan and rapidly disseminating in 171 countries worldwide⁷. This poses a significant threat to public health worldwide⁸⁻¹¹. The epidemic impacted on the China economy as well as different nations across the globe¹². Several countries including USA, Russia, Europe, Middle East, Arab and Asian countries are prohibiting visitors from China and other countries. Moreover, these countries should take serious measures to educate the public and ensure that person moved from abroad is placed in quarantine for period of two weeks.

Source of SARS CoV2

COVID-19 produced from SARS-CoV-2 originated from bats as they act as natural host due to its genetic similarities¹³⁻¹⁶. There is alteration in spike glycoprotein of SARS coronavirus-2 indicated by transmission electron, scanning electron and cryo-electron microscopic images. Instead of 2019-nCoV, this virus were named by ICTV (International Committee on taxonomy of Viruses) as SARS-CoV-2 as genetic studies showed similarity between SARS coronavirus and COVID-19 coronavirus which resulted in severe acute respiratory distress in humans¹⁷.

SARS-CoV Pathogenesis

It remained unknown to find the possible mechanism of corona virus infection. However, the disease model comprised of three phases: replication of virus, hyperactivity of immune

system and pulmonary cells destruction due to proliferation of epithelial cells, alveolar damage and macrophages infiltration^{18,19}. Although COVID-19 is associated with pneumonia, however, the infected patients are also prone to gastrointestinal symptoms such as frequent diarrhea, lymphadenopathy and splenic atrophy²⁰. The minimal disruption of intestinal cells while SARS-CoV replication in enterocytes has been attributed to the upregulation of the transforming growth factor and initiation of an antiapoptotic host cellular response in intestinal cells^{21,22}. Autopsies studies of virus affected people shown that this infection is basically systemic disease with extrapulmonary dissemination followed by shedding of virus in respiratory secretions, urine, stools and sweat¹⁴⁻¹⁵.

Diagnosis

Molecular tools are preferred for early diagnosis of SARS-CoV-2²³⁻²⁴. For asymptomatic carriers' diagnosis, viral RNA detection technique is helpful (detected by using pharyngeal swab). Such persons should be isolated so as to prevent further disease transmission²⁵. Real-time RT-PCR (rRT-qPCR) is also one of the technique performed using respiratory secretions to detect viral DNA within short time period²⁶. A diagnostic technique reverse transcriptional loop-mediated isothermal amplification (RT-LAMP) was developed by researchers for detection of COVID-19 coronavirus colorimetrically (iLACO technique). In this technique, six primers were used for amplification of fragment of the ORF 1ab gene, using pH indicator (phenol red) when amplification occurs, the color turns from pink to light yellow in positive suspects of COVID-19 while in negative cases, it remains pink²⁷.

Treatment

According to the severity of symptoms, patients should be immediately given symptomatic and supportive treatment²⁸⁻²⁹. To reduce breathing stress, therapy consists of high-flow nasal cannula (HFNC) oxygen therapy (supplementary oxygen). To counteract hypoxemia, intravenous infusion of methylprednisolone was given and in severe instance adrenaline was administered intravenously. Anti-viral drugs such as ritonavir plus lopinavir per orally and an antibiotic (moxifloxacin or any antibiotic) was administered by IM/IV route to prevent secondary bacterial infection^{28,30}. Numerous drugs are under study such as different antiretrovirals, (remdesivir, oseltamivir) chloroquine and indomethacin. Till the development of vaccine, chinese herbal medicine formula could be an alternative approach for the

prevention of COVID-19 in high-risk population which require well design population studies to evaluate the preventive effect of Chinese medicine³¹. Design and development of suitable vaccines against this virus is in process and may be time taking³². Hence, management of disease by taking precautionary measures in a scientific way is of prime concern by following different guidelines³³.

Prevention

Prevention is the only way to overcome this situation by disseminating information through social media across the globe. Education campaigns are launched to promote different precautionary measures including frequent hand washing using soap or use of sanitizers, face mask to inhibit transmission of disease. The community should refrain from crowded places and should remain inside home avoid contacts with animals. Children and elderly have greater susceptibility to disease, hence precautionary measures needs to be taken³⁴. Most important thing is to report sign and symptoms like fever, flu, sore throat and cough. Close social contacts to suspected areas and travel history and are also important factors which should not be ignored. The government of every Country should limit the foreign countries tours of travelers so as to limit their exposure to virus affected countries. Quarantine protocols must be followed for people returning back from different virus affected countries³⁵.

Conclusion

Corona (SAR CoVID-19) is a worldwide pandemic. Scientists and various health agencies across the globe are working with efforts to inhibit further spread and transmission and of virus by following strict vigilance, intervention strategies and control policies, and are in a race to fight against virus by designing suitable vaccines and medicines to keep away pandemic situation.

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