International Journal of Community Medicine and Public Health
Sharma K et al. Int J Community Med Public Health. 2020 Dec;7(12):5219-5224
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20205207

Review Article

Corona virus epidemiology: a review article

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Received: 03 September 2020
Revised: 03 November 2020
Accepted: 07 November 2020

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ABSTRACT

Corona virus disease-2019 is an infectious disease caused by SARS-Co-2. The disease started in December 2019 in Wuhan, China resulting in pandemic. Common symptoms are fever, cough and shortness of breath. Loss of apetite, anosmia, conjunctivitis and diarrhoea are fewer common symptoms. The disease is mild in most people but may progress to pneumonia, acute respiratory distress syndrome in elderly patients and those with co-morbidities. The infection is spread from one person to another via respiratory droplets or contact with infected droplets. Preventive measures include frequent and thorough hand washing, maintaining distance from potential transmitter and not touching one's face. Mask is recommended to suspects and to their caregivers. Presently there is no vaccine or specific treatment for COVID-19. Management involves treatment of symptoms, supportive care. World health organisation declared the 2019-2020 CoV outbreak a pandemic and a Public Health Emergency of International concern with death rate of 3.4%.

Keywords: Coronavirus disease-19, SARS-CoV-2, Pandemic, Pneumonia, World health organization

INTRODUCTION

Coronaviruses are transmitted from animals to human and hence zoonotic. Coronaviruses (CoV) are a large family of viruses that cause illness ranging from the common cold to more severe acute respiratory syndrome (SARS-CoV). A novel coronavirus (nCoV) is a new strain that has not been previously identified in humans. Detailed investigations found that SARS-CoV was transmitted from civet cats to humans and MERS-CoV from dromedary camels to humans. Several known coronaviruses are circulating in animals that have not yet infected humans.[1] This article reviews the evolution, clinical profile, structure, epidemiology, routes of transmission, manifestations and complications, treatment. The current situation of global and Indian scenario of pandemic along with basic protective measures against SARS Co-2 are reviewed in order to follow up research, prevention and treatment, and to provide latest understanding of this emerging infectious disease.

EVOLUTION OF CORONA VIRUS

Coronaviruses were first discovered in the 1930s when an acute respiratory infection of domesticated chickens was caused by infectious bronchitis virus (IBV).[2] In 1931, Arthur Schalk and M.C. Hawn described a new respiratory infection of chickens in North Dakota, which was characterized by gasping and listlessness, with the mortality rate 40–90%.[3] Later on, Beaudette et al successfully isolated and cultivated the infectious bronchitis virus, which caused the disease.[4] In the 1940s, two more animal coronaviruses, mouse hepatitis virus (MHV) and transmissible gastroenteritis virus (TGEV), were isolated.[5] It was not realized at the time that these three different viruses were related.[6]

Scientists first identified a human coronavirus in 1965, which caused common cold. Later on, researchers found a group of similar human and animal viruses and named them after their crown- like appearance. Several coronaviruses can infect human. This virus that causes SARS emerged in southern China in 2002 and quickly spread to 28 other countries, causing infection in 8,000 people by July 2003, and 774 deaths. A small outbreak in 2004 involved only four cases. This coronavirus causes fever, headache, and respiratory problems such as cough and shortness of breath. MERS started in Saudi Arabia in 2012. Almost all of the 2,500 cases have been in people either who were the residents of middle east or with travel history to the middle east. This coronavirus is less contagious than its SARS cousin but more deadly, killing 858 people. It has the same respiratory symptoms but can also cause kidney failure.[7] Other human coronaviruses have since been identified, including SARS-CoV in 2003, HCoV NL 63 in 2004, HCoV HKU1 in 2005, MERS-CoV in 2012, and SARS-CoV-2 in 2019.[8]

PATHOGENESIS

The coronavirus virion is an enveloped particle containing the spike (S), membrane (M), and envelope (E) proteins. In addition, some strains of coronaviruses except SCoV, express a hemag-glutinin protein (HE) that is also incorporated in the virion. The genome of coronaviruses is a linear, single-stranded RNA molecule of positive (mRNA) polarity, and with length from 28 to 32 kb.[9] Within the virion, the genome is encapsidated by multiple copies of the nucleocapsid protein (N), and has helical RNA/nucleocapsid structure. The S protein has been a focus of pathogenesis studies in mice because it appears to be the critical determinant of species specificity, host selection, cell tropism, and disease.[10]

All viruses need a receptor on membrane to enter inside the cell. Virus replication is initiated by binding of the S protein to specific receptors present on the host cell surface. For mouse hepatitis virus (MHV), the primary receptor has been shown to be the carcino-embryonic antigen cell adhesion molecule.[11] For the human coronavirus, HCoV-229E, and other group 1 coronaviruses, the receptor is amino-peptidase N.[12] The precise mechanisms of entry and uncoating is not clear but likely occur by either fusion from without or viroplexis through endocytic vesicles. For wild type mouse hepatitis virus (MHV), entry and un-coating constitute a pH independent process that is probably direct fusion mediated by a fusion peptide in the S protein.[13]

The understanding of the region of the S1 component of coronavirus that binds to receptors was the basis for studies leading to the very recent and very rapid identification of angiotensin converting enzyme 2 (ACE 2) as a receptor for SCoV.[14] The next stage in the life cycle is translation and proteolytic processing of viral replicase proteins from the input genome RNA, followed by formation of cytoplasmic replication complexes in association with cellular membranes.[15] Viral assembly occurs both temporally and physically distinct from viral replication complexes in the endoplasmic- reticulum-Golgi-intermediate compartment (ERGIC), a transitional zone between late ER and Golgi.16One of the study found that subpopulations of replicase proteins and the structural nucleocapsid (N) translocate from replication complexes to sites of assembly and may mediate the process in association with cellular membrane/protein trafficking pathways.[17]

Virus assembly in the ERGIC involves interactions of genome RNA, the membrane protein and the small membrane protein, resulting in budding of virions into the lumen of ER/golgi virosomes.[18] Further maturation of virus particles occurs during movement through the Golgi, resulting in virosomes filled with mature particles.[19] The outcome is the nonlytic release of the vast majority of mature virions into the extracellular space. Production of infectious virus continues even after the majority of cells are fused. Syncytial were recently reported as a readout of SCoV receptor expres- sion and cell infection.[14] Due to pandemic potential of SARS-CoV-2, careful monitoring is very much important to monitor its future infectivity, transmissibility, pathogenicity and virus evolution.

EPIDEMIOLOGY

Community-acquired coronaviruses are ubiquitous. In temperate climates, coronavirus respiratory infections occur primarily in the winter, although smaller peaks are sometimes seen in the spring, and infections can occur at any time of the year.[20] Although a long term study in China observed the seasonality in a subtropical region, with outbreaks at almost any time of year.[21] In other surveys, HCoV-OC43, HCoV-NL63, HCoV-229E, and HCoV-HKU1 predominate unpredictably in certain years and in certain parts of the world.[22] In almost all such surveys, HCoV-OC43 is the most common of the four strains, followed by HCoV-NL63, but the prevalence of the various strains in any particular year is often unpredictable. A large polymerase chain reaction (PCR)-based study was performed in Scotland, with sampling in over 44,000 episodes over nine years, gives information of the incidence and seasonality of community-acquired HCoV infections in relation to other respiratory viruses in a temperate climate.[23] HCoV infections were commonest in the winter, were distributed among all age groups. HCoV-associated lower respiratory tract infection hospitalization rates for under five years were calculated at 1.5 per 1000 children per year.[24]

COVID-19 PANDEMIC

This outbreak of unusual respiratory disease was recognised in December 2019 in Wuhan, China and was caused by a novel corona virus.[25] On 30th January 2020, this outbreak was declared a public health emergency of

International concern. WHO named this disease as corona virus disease 2019 (COVID-19).[26] Later on, 2019 nCoV was renamed as severe acute respiratory syndrome coronavirus- 2 (SARS-CoV-2) by the corona virus study group of International committee on virus taxonomy.[27] This disease was declared as global pandemic by WHO on 11th March 2020.[28] with death rate of 3.4%.[29] As of 1st november 2020, worst hit countries include US, India, Brazil, Russia, France, Argentina, Spain, Colombia, UK, Mexico, where India ranked at 2nd with 82,29,322 cases and 122642 deaths.[30] Globally, 46.9 Million were confirmed cases of COVID-19, with 31.4 Million recovered cases including 1.21 Million deaths reported to WHO.[30,31] There is second wave of rise in number of cases across Europe and United States breaking previous daily record of first wave. China has been one of the countries to contain it effectively from where the pandemic started.

In India, first confirmed case of COVID-19 was diagnosed on 30th January in Kerala in a medical student, returned from Wuhan followed by reporting of other two cases from Kerala.[32] As of 1st november 2020, worst hit states included Maharasthra, (1.65 Million), Andhra Pradesh (809000), Karnataka (806000), Tamil Nadu (712000) and Kerala (403000) and total confirmed cases were 82,29,322 including discharged/recovered cases 7.5 Million and deaths 122642.[30,31,33] according to MOHAFW reported in India with case fatality rate of 1.4%, one of the lowest globally.[34] There is 50% decline in daily cases from mid-September peak of 98,000 cases to almost 45,000 cases by mid-October. There is continuous increase in recovery rate with active cases less than 7%, which can beeasily handled by existing health infrastructure.

DISCUSSION

Respiratory coronaviruses probably spread similar to that of rhinoviruses, via direct contact with infected secretions or large aerosol droplets. Immunity develops soon after infection but decreases gradually over time. Reinfection is common, presumably because of decreasing immunity, but possibly because of antigenic variation within species.[35] In hospital settings, spread among paediatric patients probably occurs through shedding by their infected caretakers.[36] Outbreaks are common in long-term care facilities for older adults.[37] Middle East respiratory syndrome and severe acute respiratory syndrome are both zoonoses.[38]

Corona virus infection, ingeneral has low fatality. Cause of fatality is usually co-morbid conditions and mortality is higher in vulnerable groups like elderly people and immunocompromised. The common presentation is fever, cough, shortness of breath and breathing difficulties. Some unusual features have been found in nCovid-19 patients ranging from loss of appetite, anosmia, conjunctivitis and diarrhoea. Infection can cause pneumonia, severe acute respiratory syndrome, kidney failure and even death in severe cases.[39] Careful monitoring of potentially developing inflammatory cytokine “storm,” is needed which has been reported as playing a key role in the severe immune injury to the lungs caused by T-cell over activation and subsequent death with severe COVID-19.[40] Neurological manifestations can be considered as direct effects of the virus on the nervous system, para-infectious or post-infectious immune-mediated disease. Acute disseminated encephalomyelitis occurs weeks after an infection, usually presenting with focal neurological symptoms, often with encephalopathy.[41]

RNA of human corona virus HCoV-OC43 and HCoV-229E were more frequently detected in multiple sclerosis patients by reverse transcriptase polymerase chain reaction than in healthy individuals.[42] One of the diseases found an association of coronavirus infection with kawasaki disease.[43] Another study found no association between coronaviruses and kawasaki disease.[37,38]

Acute coronary syndrome and myocardial infarction were noted to occur after SARS.[44] Myocardial injury is likely associated with infection-related myocarditis and/or ischemia and is an important prognostic factor in COVID-19. Among SARS-CoV-2 infected patients with atypical clinical presentations, a substantial portion of these patients had GI symptoms.[45] Song et al described a SARS-CoV-2 infected patient with diarrhoea as the first symptom and suggested that the GI tract might be a route of invasion and transmission of the virus.[46]

SARS-CoV-2 infected hospital admitted patients often have leucopenia, lymphopenia, or elevated levels of peripheral neutrophils.[47] However, an exception was reported by Jin et al in which a SARS-CoV-2 infected patient had increased leukocyte and lymphocyte counts, possibly due to coexisting chronic lymphocytic leukemia masking SARS-CoV-2 infection.[48]

The adverse psychological effects (post-traumatic stress, confusion, and anger) of quarantine during infectious outbreak have been well documented.[49] Two studies have reported alcohol abuse or dependency symptoms, as long-term effects in quarantined healthcare workers after SARS epidemic.[50] Increased avoidance behaviours is common among healthcare workers after quarantine such as avoiding direct contact with patients and work absence, were found significantly associated with increased duration of quarantine.[51]

Currently no specific treatment is available for coronavirus infections, except for supportive care as needed. Several antivirals and other agents have been used during the severe acute respiratory syndrome coronavirus outbreak, but the efficacy of these drugs has not been established. The World health organisation (WHO) has accepted the initial clinical trial results from the United Kingdom (UK) that show dexamethasone can be life saving for patients who are critically ill with

COVID-19. In the absence of a vaccine and an effective antiviral chemotherapy, there is currently an intense global interest in repositioning chloroquine (CQ) and its derivative hydroxychloroquine (HCQ) to combat the pandemic. CQ has been used for decades for the treatment and prophylaxis against malaria in endemic countries.[52] Combination of chloroquine with remdesivir is effective to control the COVID-19 infection in a laboratory situation and has been used in patients with acceptable results.[53] Ivermectin in the dose of 12 mg BD alone or in combination with other therapy for 5 to 7 days may be considered as safe therapeutic option for mild moderate or severe cases of COVID-19 infection.[54]

Basic protective measures for general public include hand Washing frequently, regularly and thoroughly with soap and water or rub with 60% alcohol solution at least for 20 seconds. Staying away at a distance of 1 to 2 metre from the potential transmitter. Patients with respiratory symptoms should be asked to wear surgical masks and to avoid mass gathering and crowded places and also to avoid touching eyes, nose and mouth. Maintain good respiratory hygiene, meaning thereby covering mouth and nose with bent elbow or tissue during coughing or sneezing. Boosting immune system with indoor exercises, fresh fruits and vegetables, intake of essential nutrients like Vitamin B12 with methyl cobalamin, Magnesium, Minerals, Vitamin C etc. Regularly cleaning and disinfecting the surfaces that are frequently touched such as phones, tablets, remotes, fridges etc. Seek medical care early in case of fever, cough and difficult breathing. Stay informed about the latest developments about COVID-19 and follow advice given by healthcare provider and local public health authority. Apart from general precautions, Health care workers should wear gloves when touching blood, body fluids, secretions, excretions, mucous membrane and non-intact skin. Wearing surgical or procedure mask and eye protection i.e eye visor, goggles, face shield during procedures that are likely to generate splashes or sprays of blood, body fluids, secretions. Wear gown to protect skin and soiling of clothing. Prevention of needle stick injuries from other sharp instruments. Handle, transport and process used linen in a manner which prevents skin and mucous membrane exposure and contamination of clothing. Environmental cleaning and safe waste management. Persons such as family members, directly dealing with COVID 19 should also follow all universal precautions including social distancing.

Limitations

Our study focusses the articles published in English only. It cannot reflect the entire research on COVID-19 worldwide, still it will provide some evidences for future study.

CONCLUSION

COVID-19 is a serious infectious disease caused by novel coronavirus, SARS-Co-2. Its initial symptoms- fever, cough, shortness of breath is similar to those of SARS. The virus is highly infectious and can be transmitted through droplets and close contact. COVID-19 poses a great threat to global health and safety. Controlling the spread of epidemic and reducing mortality is a challenge. Specific mechanism of virus remains unknown. No specific antiviral drugs have been developed. At present, it is important to control the source of infection, cut off the route of transmission and to use existing drugs and means to control the progress of disease. We should also try to develop specific drugs, promote research and development of vaccines, reduce morbidity and mortality of COVID 19 in order to protect the people.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Sharma K, Sharma RL, Sharma V. Corona virus epidemiology-a review article. Int J Community Med Public Health 2020;7:5219-24.