

Zoonotic Significance of COVID-19 and Precautions Related to Animals During Outbreak of the Disease

Mahendra Pal^{1*} and Gemechu Berhanu Kerorsa²

¹Narayan Consultancy on Veterinary Public Health and Microbiology, Anand, Gujarat, India.

²College of Agriculture and Veterinary Medicine, DambiDollo University, DambiDollo, Ethiopia.

Abstract

Recent years have witnessed the emergence of several zoonotic infections causing significant morbidity and mortality in both sexes and all age groups globally. Presently, Coronavirus disease 2019 (COVID 19), caused by severe acute respiratory syndrome 2 (SARS COV-2), is an emerging viral disease that is occurring in pandemic form affecting huge population of the world. The disease has resulted in high morbidity and mortality in susceptible people worldwide. The initial source of COVID 19 has been the reservoir animal known as bat. Additionally, different animals, such as tiger, cat, and dogs have been caught by the virus. COVID 19 can be transmitted through droplet inhalation, direct contact with the infected person, and indirect contact from different objects. COVID 19 is known by different clinical signs starting from mild to severe clinical signs including high fever, dry or productive cough, difficulty of breathing and others. Even though some animals are reportedly infected by COVID 19, zoonotic significance of the disease has not been studied well. Therefore, additional comprehensive studies, and reviewing of different literatures is very important to delineate the zoonotic importance of COVID 19, and way of controlling the disease in animals.

*Corresponding author:

Professor Dr. Mahendra Pal
Email: palmahendra2@gmail.com

Received: 14/05/2020

Accepted: 04/06/2020

Keywords: Animals, Control, Coronavirus, COVID 19, Public Health, Zoonotic Importance.

1. Introduction

Coronavirus disease 2019 (COVID 19) is a life threatening viral disease, which affects the lower respiration tracts. This zoonotic ailment has triggered major worldwide threat than its predecessors. The pertinent and vital aspect for an emerging virus is its pandemic potential. It has been declared as pandemic and now is occurring in all most all parts of the world (Chen *et al.*, 2020, Gralinski and Menachery, 2020, Wang *et al.*, 2020). Coronaviruses (CoVs) belong to the genus Coronavirus (Cheng *et al.*, 2004). All CoVs are pleomorphic large RNA viruses often encompassing crown-shape peplomers with 80-160 nm in period and 27-32 kb positive polarity (Sahin *et al.*, 2020). They are non-segmented, enveloped, single-stranded, positive-sense RNA viruses (ECDC, 2020). The morbidity, mortality, mental health impact, and psychological effects due to the new COVID-19 are presently hard to expect (Contini *et al.*, 2020). Several coronaviruses cause cold-like illnesses in human beings, at the same time, others may produce illness in certain types of animals. Some coronaviruses, such as canine and feline coronaviruses, infect only the animals, and do not have the potential to produce disease in human beings (CDC, 2020). The present novel Coronavirus has the potential to affects both

humans and animals as well. Despite the fact that, COVID 19 originally came from an animal source, presently, there is no published document that animals play a tremendous function in spreading the virus (OIE, 2020). Therefore, the aim of this manuscript is to review zoonotic importance of COVID 19, and precautions related to animals in the course of the outbreak of the disease.

2. COVID-19 Background

The primary cases of severe acute respiratory syndrome (SARS) caused by SARS CoVs had been virtually identified to have emerged in mid-November 2002 in Guangdong Province, China, with the first legitimate report of an outbreak of peculiar pneumonia, and then spread internationally, most appreciably to Toronto, Canada. Later, SARS spread to more than 24 countries of the world at that point. It was expected that from November 2002 to July 2003, 8098 cases and 774 deaths have been recorded worldwide (WHO, 2003; Pal, 2018). After 10 years in 2012, the outbreak of other coronavirus disorder known as Middle East Respiratory Syndrome (MERS) turned into passed off in Saudi Arabia (Contini *et al.*, 2020). In December, 2019, there has been a deadly disease of any other coronavirus that has similarity with SARS CoV,

wherein the sufferers with pneumonia had been confirmed in Wuhan, Hube province, China, which had formerly not been detected in humans or animals. This virus was designated as 2019 novel coronavirus (2019-nCoV) by WHO in January 2020 and the disease as a result of this virus was named as coronavirus disease 2019 (COVID-19) in February 2020 (Sahin *et al.*, 2020, WHO, 2020). This virus has no consistent behavior, and its story continues to evolve (Guarner, 2020). Currently, COVID-19 has become one of the globally occurring diseases affecting more than 4.6 million human beings with recorded death of greater than 311,425 humans all over the world.

3. Characteristics and Viral Structure

Coronavirus have the largest identified RNA genomes, containing approximately 30 kb genomes. The entire genome sequencing and genetic analysis discovered out that SARS-CoV-2 is closely related to SARS-CoV, and genetically clusters inside the genus beta-Coronavirus, forming awesome clade in lineage B of the subgenus Sarbecovirus collectively with two bat-derived SARS-CoV-like strains (WHO, 2020; Zhu *et al.*, 2020). All coronavirus genomes are organized in addition with the replicase locus encoded within the 5' end, and the structural proteins encoded within the 3' third of the genome organized in the order hemagglutinin esterase, if present (it has been only determined in some beta-coronaviruses), spike, small membrane, membrane and nucleocapsid, and internal protein, encoded in the N gene. The nucleocapsid protein complexes with the genome RNA to form a helical capsid shape observed in the viral envelope. Trimers of the spike protein form the peplomers embedded inside the envelope giving the virion its corona or crown-like morphology. In some coronavirus virions, the HE protein forms smaller spikes on the membrane. Membrane and nucleocapsid are also transmembrane proteins involved in virus assembly (Weiss and Leibowitz, 2011).

4. Risk Factors and Transmission

While the animals are believed to be the unique source, the virus spread is now from person to person (human-to-human transmission) (CDC, 2020). There is not sufficient epidemiological data right now to decide how effortlessly this virus spreads among people. However, it is currently expected that, on average, one infected person will infect on average three other people. The virus appears to be transmitted particularly via small breathing droplets through sneezing, coughing, or while people have interaction with each other for some time in close proximity (generally less than one meter). These droplets can then be inhaled, or they are able to land on surfaces that others may additionally come into touch with, who can then get infected, once they contact their nose, mouth or eyes. The virus can live on different surfaces from several hours (copper, cardboard) up to a few days (plastic and

stainless steel). But, the amount of viable virus declines over time, and not usually found in sufficient numbers to cause illness. The incubation period for COVID-19 (i.e. the time among exposure to the virus and onset of symptoms) is currently predicted to be between 1 and 14 days (ECDC, 2020).

The feasible ways of transmission of the infection include droplet inhalation, direct contact with the individual infected, and indirect contact from different objects (Chen *et al.*, 2020; WHO, 2020). The proposed reservoirs for coronavirus inflicting COVID-19 are animals commonly bats. Protein sequences alignment and phylogenetic evaluation confirmed that turtles, pangolin and snakes have been alternative intermediate hosts. Human-to-human transmission also can be caused during aerosol-generating medical techniques, remains a situation in particular events. Furthermore, SARS-CoV can be transmitted from bats to palm civets or dromedary camels, and finally to people (Guo *et al.*, 2020; Wu *et al.*, 2020). Peridomestic mammals also can serve as intermediate hosts, facilitating recombination and mutation occasions with growth of genetic diversity. The re-emergence of the virus from its animal reservoir remains feasible (Poon *et al.*, 2004).

There are unique risk factors available to facilitate the chance of transmission of the illness, which includes poor sanitation. The risk factors are aged people above 70 years of age, and persons with underlying health situations, such as high blood pressure, diabetes, cardiovascular ailment, chronic respiratory disease, and cancer (WHO, 2020). After entrance into the body, the virus replicates locally in cells of the ciliated epithelium, inflicting cellular damage and infection. Current information established that angiotensin-converting enzyme 2 (ACE 2), a membrane exopeptidase, is the receptor utilized by SARS-CoV-2 for entry into the human cells, just like SARS-CoV. The incidence peaks arise within the winter, taking the form of local epidemics lasting a few weeks or months. The same serotype may also return to an area after several years. The possibility of transmission before the development of signs and symptoms cannot be excluded. This raises the problem that asymptomatic individuals can transmit the virus (Contini *et al.*, 2020).

5. Clinical Symptoms

The infectious time of COVID 19 may start one to two days before symptoms appear, but people are most likely infected during the symptomatic period, even if the symptoms are mild, and non-specific. The infectious period is now estimated to last for 7-12 days in moderate cases, and up to two weeks on average in severe cases. The symptoms of COVID-19 vary in severity from having no symptoms at all (being asymptomatic) to showing fever, cough, sore throat, general weakness, fatigue, and muscular pain, and in the most serious cases, severe pneumonia, acute

respiratory distress syndrome, sepsis and septic shock, all potentially leading to death (Huang *et al.*, 2020; WHO, 2020). Reports show that clinical deterioration can happen rapidly, often during the second week of disease. Additionally, anosmia (loss of the sense of smell) may occur (ECDC, 2020). The case fatality rate of COVID 19 is 0.5-3%. Although SARS-CoV-2 can cause a severe respiratory illness like SARS and MERS, evidence from clinics has indicated that this virus is generally less pathogenic than SARS-CoV, and much less than MERS-CoV (Contini *et al.*, 2020; Velavan and Meyer, 2020).

6. Zoonotic Importance

Coronaviruses are viruses that circulate among the animals with some of them additionally recognized to infect humans. Rhinolophus bats (Horseshoe bats) are considered natural hosts of these viruses, yet different species of animals also are known to act as sources. As an example, Middle East Respiratory Syndrome Coronavirus (MERS-CoV) is transmitted to human beings from the camels, and Severe Acute Respiratory Syndrome Coronavirus-1 (SARS-CoV-1) is transmitted to people from the civet cats (ECDC, 2020). The epidemiological linkage of the initial human cases of the 2003 pandemic to wild game animals suggested that SARS CoV is zoonotic in beginning (Cheng *et al.*, 2007). The latest analysis of the SARS-CoV-2 genome has determined that it shares 96 percent of its RNA with a coronavirus, which was previously identified in a selected bat species in China (Contini *et al.*, 2020; Giovanetti *et al.*, 2020).

Currently, there is no sufficient scientific evidence to identify the source of SARS-CoV-2 or to explain the original route of transmission to human beings. Dogs, cats (domestic cats and a tiger), and minks when tested were found positive for SARS-CoV-2 in the field placing, following the close contact with infected human beings (or humans suspected to be infected with SARS-CoV-2), but poultry, and pigs are not susceptible to the infection. Cats are the most susceptible species for SARS-CoV-2, and cats can be affected with clinical disorders. Within laboratory conditions, cats were able to transmit infection to different cats. Presently, there is no evidence that animals are playing a considerable epidemiological role in the spread of human infections with SARS-CoV-2. However, animals and people can sometimes share sicknesses, known as zoonotic infection (Pal, 2005; OIE, 2020, WHO, 2020). Presently, there are over 300 zoonotic diseases of varied etiologies, which are reported from developing as well as developed nations of the world (Pal, 2007; Pal, 2013). The first case in the USA of an animal testing positive for the virus that causes COVID-19 was a tiger with a respiratory sickness at a zoo in New York City of USA. Samples from this tiger had been collected and tested after numerous lions and tigers at the zoo showed symptoms of respiratory illness. Public health officials believe

these large cats became ill after being exposed to a zoo worker who was inflamed with the virus that causes COVID-19 (CDC, 2020; Contini *et al.*, 2020).

7. Treatment, Control and Prevention Measures

Currently, there is no actual and precise antiviral treatment of coronavirus disease 2019. However, the supportive treatments consist of antiviral treatment with interferon alpha inhalation and arbidol (Xu *et al.*, 2020), protease inhibitor (Lopinavir/ritonavir) in combination with ribavirin, nelfinavir (Beutels *et al.*, 2009); corticosteroids to hose down excessive lung damage due to an inflammatory reaction (Nie *et al.*, 2003), high flow oxygen supplementation, and mechanical ventilation in case of respiratory failure; and tracheostomy is needed in patients requiring prolonged mechanical air flow and ICU stay with strict infection control (Guo *et al.*, 2020; Pal *et al.*, 2020); PLpro to discover potential inhibitors of its catalytic area (Chen *et al.*, 2020; Lu *et al.*, 2020); arbidol, quinolones, second generation beta lactam (Xu *et al.*, 2020).

There are various approaches of the prevention and control of COVID 19. These include covering of the nose and mouth while coughing or sneezing, the use of tissues to contain respiratory secretions and getting rid of tissues within the nearest waste depot after use, heading off contact with different objects with hands and then touching eye, averting touch with diseased and suspected character, nose and mouth, physical distancing, lockdown, and staying home all through outbreak, using different alcohols and sanitizers to disinfect hands and different objects before using in each daily life activity, isolation of infected patients, and proper testing of quarantine of suspected cases (ECDC, 2020; Pal *et al.*, 2020). Effective education of the staff and public about the infection control, using personal protective equipment used throughout handling of the case, using masks, proper washing of hands regularly with water and soap, cleaning the environment, controlling affected person transport especially from epidemic areas, early analysis, isolation, and quarantine of the confirmed and suspected instances (Chen *et al.*, 2020; Pal *et al.*, 2020). It is pertinent to identify and reduce transmission from human and animal sources (WHO, 2020). Reducing the spread and transmission of the infection for this newly emerged coronavirus nowadays, is the best preventive method, we can have within the absence of vaccine or unique drug (Contini *et al.*, 2020). Presently, many scientists and researchers are working day and night to find a potent vaccine and effective treatment for this emerging virus. All communities of the world including the scientists, researchers, medical workers, and veterinarians ought to observe One Health approach to get rid of this devastating viral disease.

8. Care Needed for Animals during Control of COVID 19

While there are COVID-19, particular precautions to be taken during interaction with animals, it is usually best - as a standard rule - to practice proper hygiene, and observe bio-security measures. This includes frequent washing of hands with cleaning soap and water after touching the animals, and cleaning and disinfecting any farm machinery/system (Pal *et al.*, 2020). FAO strongly urged every person - humans, countries, organizations, corporations, and companies - to continue to treat animals with the maximum respect and practice across the world accepted animal welfare standards. Deceptive information on the animals' role within the COVID-19 pandemic maintains to circulate (FAO, 2020). There is no justification for abandoning, rejecting, mistreating or killing the animals because of issues over COVID-19. Additionally, FAO does no longer suggest ordinary testing of the animals for this virus. Since the scenario is ever evolving, public and animal health workers may determine to test certain animals showing the symptoms and with recognized contact with humans who have COVID-19 out of an abundance of warning (Chen *et al.*, 2020). Hitherto, no information is available that may be linked to foods of any type, such as meat and products from fish, and wildlife. Similarly, critical following of strict environmental sanitation, personal hygiene, and food protection measures to prevent cross-contamination is most important to control any foodborne illness, ensure food safety, and, overall, lessen the probability of sicknesses to emerge or reemerge (FAO, 2020; OIE, 2020).

9. The Role of Veterinarians during Outbreak of COVID-19

It is very crucial for the veterinary services to reassure everyone that is safe to keep, rear, maintain and care for pets, draft animals, and livestock, and also for veterinarians to maintain their activities even during lockdown (surveillance, vaccination, outbreak investigations in the case of disease events, basic veterinary care and border control) (OIE, 2020). Veterinary Authorities should also remain informed, and maintain close contact with Ministries of Health and Forestry, Natural Resources or Wildlife, to ensure coherent and appropriate interventions and investigations, risk communication messages, and risk management using a One Health approach. Effective

References

Beutels P, Jia N, Zhou Q, Smith R, Cao W and Vlas SJ (2009). The economic impact of SARS in Beijing, China. *Tropical Medicine and International Health*, 14: 85-91. <https://doi.org/10.1111/j.1365-3156.2008.02210.x>.
CDC (2020). Center for Disease Control and Prevention. <https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/animals.html>. Accessed on May 11, 2020.

bio-security risk control and cooperation with inspection authorities should be maintained at borders. Any consideration of SARS-CoV-2 virus in an animal should be reported to the World Organization for Animal Health (FAO, 2020; OIE, 2020).

10. Conclusion

COVID 19 has been declared as a viral pandemic disease by the World Health Organization. The outbreak by novel coronavirus has caused havoc on the entire world resulting significant morbidity and mortality in susceptible people. The disease is primarily spread through droplets produced when an infected person coughs, sneezes, or speaks. It has been distributed to almost all countries of the world causing major economic, political, social, and psychological impact. As its initial origin is from animals, such as bat, it is considered as zoonotic viral disease. Although it is zoonotic disease, COVID 19 has been mostly transmitted from person to person through droplet inhalation, direct or indirect contact. Several risk factors associated with the disease include elderly age, and those with underlying health conditions or immunocompromised people. It causes various respiratory and systemic clinical syndromes. As there is no specific antiviral therapy, the treatment given for the disease is almost supportive. Hitherto, zoonotic implication of the newly emerged viral disease is not well studied. Therefore, it is highly imperative that further detailed research should be conducted to conclusively establish the role of animals as transmitter of COVID 19 to human beings.

Acknowledgements

The authors are highly grateful to Prof. Dr. R.K. Narayan for his suggestions in manuscript. The computer help of Anubha Priyabandhu is very much appreciated

Author's Contribution: All the authors contributed equally. They read the final version, and approved it for publication.

Conflict of Interest: The authors declare that they have no conflict of interest.

Source of Financial Grant: There was no financial support.

Chen Y, Liu Q and Guo D (2020). Emerging coronaviruses : Genome structure, replication, and pathogenesis. *Journal of Medical Virology*, 92: 418-423.
Cheng CC, Lau KP, Woo CY and Yuen KY (2007). Severe acute respiratory syndrome Coronavirus as an agent of emerging and re-emerging infection. *Clinical Microbiology Reviews*, 20: 660-694.

- Cheng PK, Wong DA, Tong LK, Ip SM, Lo AC, Lau CS, et al. (2004). Viral shedding patterns of coronavirus in patients with probable severe acute respiratory syndrome. *Lancet*, 363:1699-1700.
- Contini C, Di Nuzzo M, Barp N, Bonazza A, De Giorgio R, Tognon M, et al. (2020). The novel zoonotic COVID-19 pandemic: An expected global health concern. *Journal of Infection in Developing Countries*, 14: 254-264. doi:10.3855/jidc.12671.
- ECDC (2020). European Centre for Disease Prevention and Control. <https://www.ecdc.europa.eu/en/covid-19-pandemic>. Accessed on May 8, 2020.
- FAO (2020). Food Agricultural Organization. <http://www.fao.org/news/story/en/item/1270557/icode/>. Accessed on April 20, 2020.
- Giovanetti M, Benvenuto D, Angeletti S, Ciccozzi M (2020). The first two cases of 2019-nCoV in Italy: Where they come from? *Journal of Medical Virology*, 92: 518-521.
- Gralinski LE and Menachery VD (2020). Return of the coronavirus: 2019-nCoV. *Viruses*, 12: E135.
- Guarner J (2020). Three emerging coronaviruses in two decades the story of SARS, MERS, and now COVID-19. *American Journal of Clinical Pathology*, 1-2. <https://doi.org/10.1093/AJCP/AQAA029>.
- Guo Y, Cao Q, Hong Z, Tan Y, Chen S, Jin H, et al. (2020). The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak – an update on the status. *Military Medical Research*, 7: 11.
- Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. (2020). Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*, 395: 497-506. doi: 10.1016/S0140-6736(20)30183-5.
- Lu R, Zhao X, Li J, Niu P, Yang B, Wu H, et al. (2020). Genomic characterization and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. *The Lancet*, 395: 565-574. [https://doi.org/10.1016/S0140-6736\(20\)30251-8](https://doi.org/10.1016/S0140-6736(20)30251-8).
- NieQ, Luo X and Hui W (2003). Advances in clinical diagnosis and treatment of severe acute respiratory syndrome. *World Journal of Gastroenterology*, 9: 1139-1143.
- OIE (2020). World Organization for Animal health. <https://www.oie.int/en/scientific-expertise/specific-information-and-recommendations/questions-and-answers-on-2019novel-coronavirus/>. Accessed on May 12, 2020.
- Pal M (2005). Importance of zoonoses in public health. *Indian Journal of Animal Sciences*, 75: 586-591.
- Pal M (2007). Zoonoses. Second Edition. *Satyam Publishers, Jaipur, India*.
- Pal M (2013). Public health concern due to emerging and re-emerging zoonoses. *International Journal of Livestock Research*, 3: 56-62.
- Pal M (2018). Severe acute respiratory syndrome: A newly recognized viral zoonosis of public health concern. *Acta Scientific Microbiology*, 1(6): 01.
- Pal M, Berhanu G, Desalegn C and Kandi V (2020). Severe acute respiratory syndrome Coronavirus-2 (SARS-CoV-2): An update. *Cureus*, 12(3): e7423. Doi: 10.7759/cureus.7423.
- Poon LLM, Guan Y, Nicholls JM, Yuen KY and Peiris JSM (2004). The aetiology, origins, and diagnosis of severe. *Lancet Infectious Diseases*, 4: 663-671.
- Sahin AR, Erdogan A, Agaoglu PM, Dineri Y, Senel ME, Okyay RA, et al. (2020). 2019 Novel Coronavirus (COVID-19) outbreak: A review of the current literature. *Eurasian Journal of Medicine and Oncology*, 4(1): 1-7. <https://doi.org/10.14744/ejmo.2020.12220>
- Velavan TP and Meyer CG (2020). The COVID-19 epidemic. *Tropical Medicine and International Health*, 25: 278-280.
- Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. (2020). Clinical characteristics of 138 hospitalized patients with 2019 novel Coronavirus-infected pneumonia in Wuhan, China. *Journal of American Medical Association*. Doi:10.1001/jama.2020.1585.
- Weiss SR and Leibowitz JL (2011). Coronavirus pathogenesis. In *Advances in Virus Research* (1st ed., Vol. 81). <https://doi.org/10.1016/B978-0-12-385885-6.00009-2>.
- WHO (2003). Consensus document on the epidemiology of severe acute respiratory syndrome (SARS). *World Health Organization, Geneva, Switzerland*, 1-47.
- WHO (2020). World Health Organization <http://www.who.int/health-topics/coronavirus/who-recommendations-to-reduce-risk-of-transmission-of-emerging-pathogens-from-animals-to-humans-in-live-animal-markets>. Accessed on May 12, 2020.
- Wu A, Peng Y, Huang B, Ding X, Wang X, Niu P, et al. (2020). Genome composition and divergence of the novel Coronavirus (2019-nCoV) originating in China. *Cell Host and Microbe*, 1-4. <https://doi.org/10.1016/j.chom.2020.02.001>.
- Xu X, Wu X, Jiang X, Xu K, Ying L, Ma C, et al. (2020). Clinical findings in a group of patients infected with the 2019 novel coronavirus (SARS-Cov-2) outside of Wuhan, China: retrospective case series. 1-7. <https://doi.org/10.1136/bmj.m606>.
- Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. (2020). A Novel Coronavirus from patients with pneumonia in China, 2019. *New England Journal of Medicine*, 382:727-733.