

How Coronavirus is Susceptible in Animals?

Rida Asrar*, Anas Sarwar Qureshi, Sadia Yousuf, Amna Shakoor, Basam Shahzad, Moazzam Ali and Hafiz Muhammad Taimoor Ihsan

Faculty of Veterinary Science, University of Agriculture, Faisalabad, Pakistan

***Corresponding Author:** Rida Asrar, Faculty of Veterinary Science, University of Agriculture, Faisalabad, Pakistan.

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Abstract

Among the infections raising concern, a Respiratory Syndrome, caused by the coronavirus belongs to family coronaviridae is RNA virus having linear positive sense RNA genome. Infections associated with this virus are creating life threatening conditions from Middle East to the Asia very quickly now days. China reported many cases since 2019, as China shares border with Pakistan, we have to adopt preventive measures to control the situation. Coronaviruses are common in many different species of animals, including camels, pigs and bats. These coronaviruses can also infect humans and then spread between humans as plague. Recent examples of this include SARS-CoV (Severe acute respiratory syndrome coronavirus) and MERS-CoV (Middle East respiratory syndrome coronavirus). Corona virus is severe and lethal virus with its new emerging variants. In the present time it is of great importance because of pandemic. It is resulting in huge destruction all around the world. The economy of the world has decreased enormously due to this tiny but lethal virus. It not only affects the humans but also affecting the animal's species.

Keywords: *Coronavirus; Contagious; Zoonotic*

Introduction

To understand the mechanism of this virus through which it causes the disease first of all a thorough understanding of its structure is necessary. Coronavirus is a RNA virus which is an enveloped, positive sense, single stranded RNA genome [4,6,9]. It contains a nucleocapsid of helical symmetry. Genome size of this virus is approximately 26.32 kilobases. It shows that it is one of the largest virus among the RNA viruses [14]. Coronavirus have club-shaped type of spikes that in electron microscope creates an image of reminiscent of solar corona. That's how the name for the virus "coronavirus" was derived [3]. Diameter of the virus is approximately 80 - 120 nm [2,9]. Average molecular mass is almost 40,000kDa. It consists of an envelope made up of lipid bilayer [5]. Envelop of lipid bilayer, membrane proteins and nucleocapsid is present outside the body of host to give it protection [1,7]. Diameter of the envelope is approximately 85nm in size.

History of coronavirus

Coronavirus causes respiratory disease whose symptoms varies from simple cold to severe acute respiratory syndrome (SARS). MERS-COVID middle east respiratory syndrome caused by corona virus was first identified in Saudi Arabia in year 2012 [13,29]. Reports from the early time in the animals regarding infection from coronavirus were from late 1920s; basically there the infection was seen in the domesticated chickens in North America [23]. In 1933 this virus was successfully isolated by Leland David Bushnell and Carl Alfred Brandy.

After isolating this virus they called it IBV (Infectious Bronchitis Virus) Charles D. Hudson and Fred Robert Beaudette cultivated this virus for the very first time in the history in year 1937 [15]. Talking about the history of the corona virus it is important to mention that the Human coronavirus was first discovered in 1960s which in today's life is of great importance because of the vast destruction it is creating [17,30]. In history 2 regional pandemics caused by the families of coronavirus [25], 774 people expired by severe acute respiratory syndrome (SARS) in 2001-2003 and 858 people expired by Middle East respiratory syndrome (MERS) in 2012-2015.

Classification

The name of the "coronavirus" is basically derived from Latin word (corona) that means "Crown" OR "Wreath". Till now almost 45 species have been recognized [10]. Coronavirus belongs to family Coronaviridae, subfamily of coronavirus is Orthocoronavirinae, Order is Nidovirales and realm Riboviria. They are divided into four genera: Alphacoronavirus, Betacoronavirus, Gammacoronavirus and Deltacoronavirus [5,21].

It is estimated that the most recent of the ancestors of the coronavirus were in the 8000BCE, but on the other hand some of the recent models also suggest that its origin is as early as 55 million years or even more [8]. The origin of alphacoronavirus is estimated to be in 2400 BCE, origin of betacoronavirus in 3300 BCE, gammacoronavirus in 2800 BCE and origin of deltacoronavirus is estimated in 3000 BCE. Birds and bats are the natural reservoir of the coronavirus [11]. Considering alphacoronavirus and betacoronavirus bats are the natural reservoirs. Birds are the natural reservoir for gammacoronavirus and deltacoronavirus [19].

Coronavirus is a zoonotic virus and the present pandemic is its evidence. Coronavirus is transmitted from one host to another host through aerosol, feco-oral route and fomites [27]. Infected host can shed the virus in the environment. Interaction of the spike protein of the coronavirus with the complementary cell receptors of the host is the main event defining the infectivity [24]. It is determined that coronavirus mainly infect the epithelial cells of the host. In the case of the animals this virus mainly affects the epithelial cells of the digestive tract and similarly in the case of the human coronavirus it affects the respiratory tract epithelial cells [18]. Reverse zoonosis which is also known as zoonanthroponosis also observed in pets dogs and animals due to close contact with infected person.

Middle east respiratory syndrome (MERS-COV)

Middle East respiratory syndrome was firstly identified in 2012 in Saudi Arabia. It is a viral disease that mainly affects the respiratory system. Other than respiratory system it also involves many systems of the body [31]. That symptom ranges from simple cold to severe acute respiratory syndrome (SARS). MERS-COV is a zoonotic virus that can be transmitted to humans from animals.

Typical symptoms that occur in MERS are Fever, Cough, Shortness of breath, Pneumonia (not in every case), and gastrointestinal symptoms like diarrhea. In some cases it is observed that there are no symptoms visible for MERS-COV but laboratory tests still confirms the disease.

If we discuss about the mortality rate of MERS-COV it is almost 35% of the infected patients those died of the disease. Dromedary camels are the basic reservoir hosts for the MERS-COV. Camels are responsible for the disease transmission cases of MERS-COV in humans [26]. In the case of non- human to human transmission this virus is transferred from dromedary camels to humans and in human to human transmission this virus is transmitted by the direct contact.

Prevention and treatment

The treatment depends upon the symptoms and is supportive. Currently there is no treatment and vaccine available for the treatment hence we do supportive treatment. Proper hygienic measures should be adapted when visiting the farms etc. like camel farms [28]. Direct

contact with the sick animals should be avoided. Raw or un-cooked food should be avoided. Camel milk and meat should undergo proper treatment like pasteurization and heat treatments to ensure that it is properly cooked.

Canine corona virus (CCoV)

It is a gastrointestinal disease of puppies caused by the family of corona virus. Its structure is like projection of rings which looks like coronet shape. Short term infection which cause the severe abdominal pain. It has no zoonotic appearance. CCoV is genetically related to the corona viruses of pigs and cats. CCoV is divided into two genotypes, CCoV type-I (CCoV-I) and type-II (CCoV-II) [14]. It mainly affects the gastrointestinal tract. The virus generally affects the epithelial linings of small intestine, causing gastroenteritis and leading to fatal diarrhea. Sometimes virus also infects the upper respiratory tract of dogs.

Most of time virus remain latent phase and don't show any clinical signs. In puppies it shows severe clinical signs like diarrhea, anorexia and dullness. Their feces has very unpleasant smell with slight orange colour, sometimes also has mucus or blood in it. If it is accompanied by parvovirus in dogs the situation might get worse. In dogs it is transmitted through Oro fecal route, also spread by contact with the infected ones. Over populated area and poor sanitary conditions also the main factors in their spread. 1 - 4 days by orofecal route. Illness continues till 10 days, after recovery infected dogs become carrier upto 6 months.

Treatment and vaccine

No specific treatment available for viral disease, antibiotics use to treat secondary bacterial infections. In case of sever diarrhea dehydration occurs, so fluid therapy use to treat loss of water and electrolytes. Vaccine are available but used after consulting the veterinarian as the can risk life of your dog.

Feline CoVs

Feline Enteric Coronavirus (FECV) is a virulent strain of corona virus present in domestic cats that leads to the fatal diseases in cats. FIPV is classified into two forms, wet and dry form [14]. FIPV starts to replicates in the epithelial cells of the pharynx or in the intestinal tract that is jejunum then there is rapid spread of the virus in the abdomen and thorax. That result in lethal inflammation, and is sometimes leads to the neurological disorders.

Porcine CoVs

Porcine Respiratory Virus (PRCoV) is a strain of coronavirus that mainly affects the pigs and its piglets. Its strain was originally derived from the bats and then rodents act as the intermediate hosts. That virus was first circulated among the cattles and then it has been modified from bovine CoV (BCoV) to become porcine CoV (BCoV) [32]. The newly emerged porcine CoV in Europe, PEDV, causes significant increase in cases leads to morbidity and mortality of piglets. Their sign includes the intestinal infections that might leads to the nervous system issues among animals.

Bovine CoVs (BCoVs)

BCoV infection becomes the cause of huge economic disturbance due to financial losses in the cattle industry and infection rate could be exceeded to camel herds. BCoV affects the respiratory and gastrointestinal tracts of animals, leads to severe diarrhea in calves, with or without respiratory disease. If there is bloody diarrhoea it can end up with high mortality rate [16]. In case of long term diarrhoea it can leads to the destruction of the villi. In case of adult cattle, the infection rate can be severe or fatal when combined with other factors like aging, off feed, hard work, improper nutrition, mainly stress during transportation.

Bird CoVs

As the birds are the natural reservoirs of gamma and delta coronavirus. This can infect a wide range of fowl species. As Virus are contagious, ends up with high economic losses to the poultry industry [20]. It is transmitted by aerosols method because of its replication in the upper respiratory tract and it affects the alimentary canal along the kidneys, gonads, and bursa, causing a dramatic drop in egg production.

Dromedary camel CoVs

The strain of coronavirus that causes infection in camels, also leads to morbidity and mortality among them. It is mainly the derivation of MERS-CoV, that generally affects the respiratory tract by showing signs like fever, nasal and lachrymal discharge, coughing, sneezing and loss of appetite.

Effects of present pandemic on animals

Present situation of pandemic is also resulting in number of cases in animals. Recently it has been reported that in the Bronx Zoo a tiger is tested positive for coronavirus. It is being considered that this tiger Nadia and other 6 big cats were infected by the keeper of the zoo who was asymptomatic:

- Many other cases are also seen also in wild animals. Due to which selling of live wild life banned to conserve human as well as animals from novel corona virus.
- China also temporarily banned wild animals for hunting, transport, consumption, medicinal and research purpose and culls the already captured animals.
- Mink fur farms in many countries also suffered the outbreak and animals died by wound and eye infection, other animals use the dead animals for food which ultimately increase the stress level, weekend immunity and susceptibility of getting virus also increased.
- Also reported the mutation of novel virus found in min farms due to which the fur industry also seen sharp declined.
- When we see companion animal cats are more susceptible to SARS- COV 2 than dogs, shown by the 49 cases reported in cats in US and 35 cases in dogs.

Conclusion

Although corona virus is commonly present among different farm and companion animals, that cause various alimentary and respiratory diseases in animals. These factors lead to the economical losses. One of the strains SARC-CoV has the zoonotic importance that can be controlled by proper hygienic measures. Suffering animals has to be quarantined for the specific time being. There is a need of cooperation between veterinary and public health departments to control the disease. Currently there is huge diversity of coronaviruses that vary species to species and shows that corona virus is susceptible in animals.

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