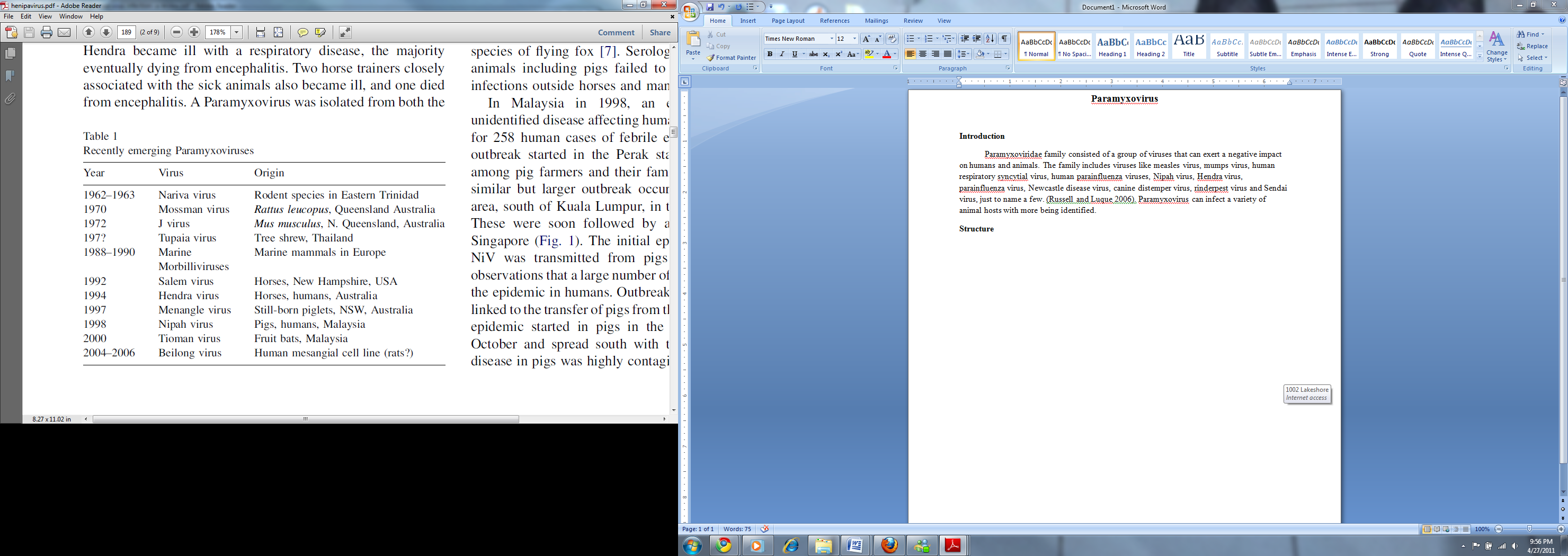
**Paramyxovirus**

**Introduction**

Paramyxoviridae family consisted of a group of viruses that can exert a negative impact on humans and animals. The family has five genera that include viruses like measles virus, mumps virus, human respiratory syncytial virus, human parainfluenza viruses, Nipah virus, Hendra virus, parainfluenza virus, Newcastle disease virus, canine distemper virus, rinderpest virus and Sendai virus, just to name a few. (Russell and Luque 2006). Paramyxovirus can infect a variety of animal hosts with more being identified.



A table showing discovery timeline of various paramyxoviruses causing diseases in animals.

**Structure**

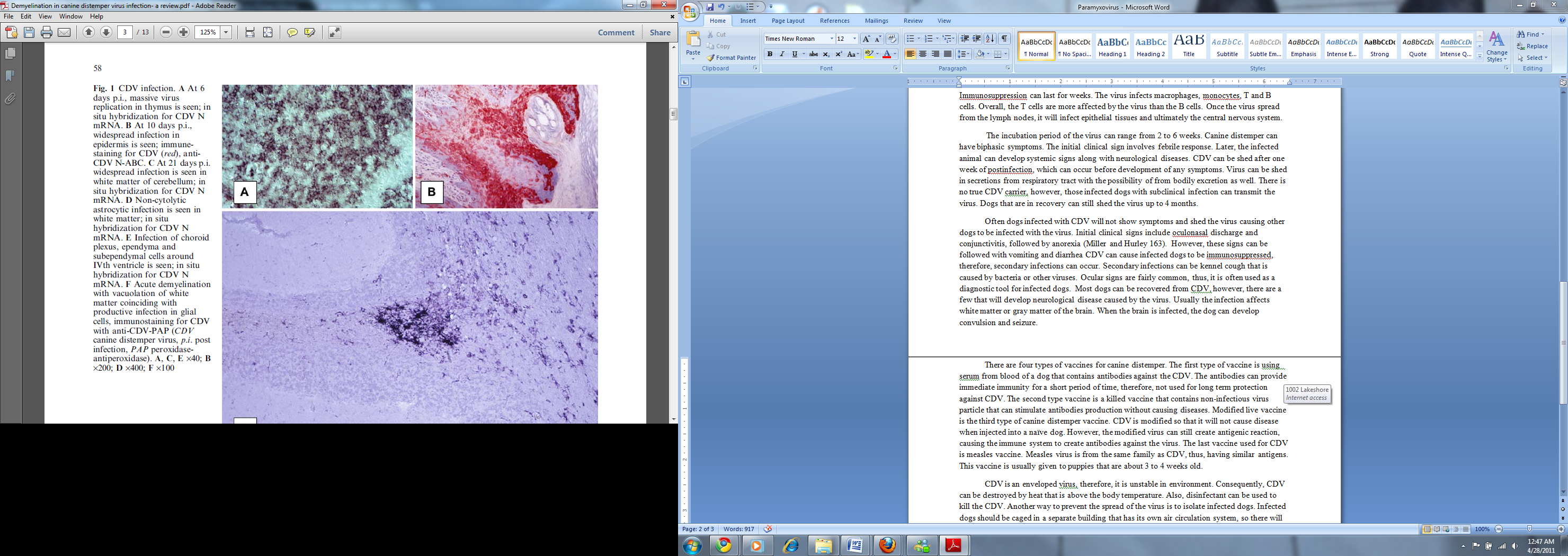
Paramyxovirus is an enveloped, negative sense, non-segmented, single stranded RNA with a helical nucleocapsid and a genome of 15 to 18 kb in length. RNA associated proteins are nucleocapsid protein (NP), polymerase phosphoprotein (P), and large protein (L). NP involves in viral transcription, packaging, and assembling of the viral particle. P and L will complex together to form RNA polymerase. The L consists of the polymerase activity, while the function of P remains to be elucidated. Together, NP, P and L support the encapsidation of the virus. Matrix proteins act as a bridge by connecting the nucleocapsid to the lipid envelope. The viral envelope contained two glycoproteins: fusion protein (F) and hemagglutinin-neuraminidase, which are needed for attachment of the virus onto a host cell.

**Replication**

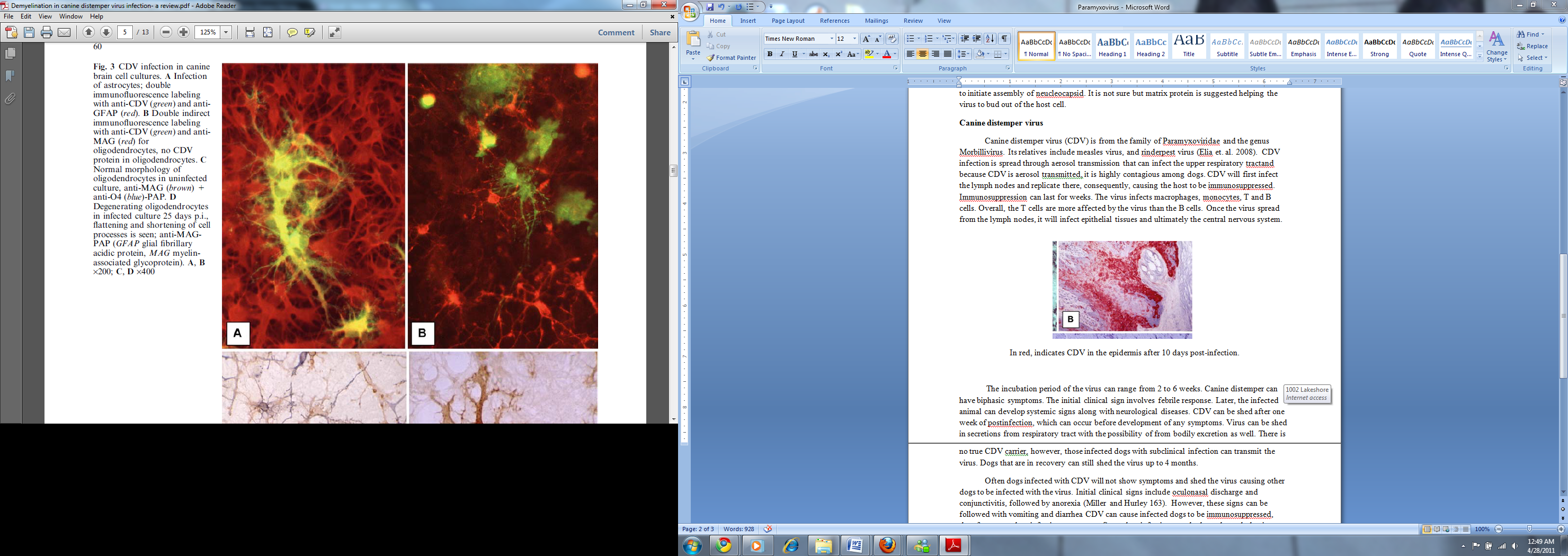
The virus will enter into the host cell through receptor mediated endocytosis. Hemagglutinin-neuraminidase will bind to the sialic acid containing receptor on the host cell. The process is aided by the fusion protein. Once bound, the virus will release its RNA, NP, and enzymes into the cytoplasm of the host cell. The negative sense RNA will need to be transcribed into positive sense RNA that will subsequently act as a template to make subgeonmic RNA. Once transcription and translation are done, NP, P and L will bind to the newly synthesized RNA to initiate assembly of neucleocapsid. It is not sure but matrix protein is suggested helping the virus to bud out of the host cell.

**Canine distemper virus**

Canine distemper virus (CDV) is from the family of Paramyxoviridae and the genus Morbillivirus. Its relatives include measles virus, and rinderpest virus (Elia et. al. 2008). CDV infection is spread through aerosol transmission that can infect the upper respiratory tractand because CDV is aerosol transmitted, it is highly contagious among dogs. CDV will first infect the lymph nodes and replicate there, consequently, causing the host to be immunosuppressed. Immunosuppression can last for weeks. The virus infects macrophages, monocytes, T and B cells. Overall, the T cells are more affected by the virus than the B cells. Once the virus spread from the lymph nodes, it will infect epithelial tissues and ultimately the central nervous system.



In red, indicates CDV in the epidermis after 10 days post-infection.



CDV in green found in astrocytes (A) and oligodendrocytes (B).

The incubation period of the virus can range from 2 to 6 weeks. Canine distemper can have biphasic symptoms. The initial clinical sign involves febrile response. Later, the infected animal can develop systemic signs along with neurological diseases. CDV can be shed after one week of postinfection, which can occur before development of any symptoms. Virus can be shed in secretions from respiratory tract with the possibility of from bodily excretion as well. There is no true CDV carrier, however, those infected dogs with subclinical infection can transmit the virus. Dogs that are in recovery can still shed the virus up to 4 months.

Often dogs infected with CDV will not show symptoms and shed the virus causing other dogs to be infected with the virus. Initial clinical signs include oculonasal discharge and conjunctivitis, followed by anorexia (Miller and Hurley 163). However, these signs can be followed with vomiting and diarrhea CDV can cause infected dogs to be immunosuppressed, therefore, secondary infections can occur. Secondary infections can be kennel cough that is caused by bacteria or other viruses. Ocular signs are fairly common, thus, it is often used as a diagnostic tool for infected dogs. Most dogs can be recovered from CDV, however, there are a few that will develop neurological disease caused by the virus. Usually the infection affects white matter or gray matter of the brain. When the brain is infected, the dog can develop convulsion and seizure.



A dog with CDV, showing nasal discharge.

There are four types of vaccines for canine distemper. The first type of vaccine is using serum from blood of a dog that contains antibodies against the CDV. The antibodies can provide immediate immunity for a short period of time, therefore, not used for long term protection against CDV. The second type vaccine is a killed vaccine that contains non-infectious virus particle that can stimulate antibodies production without causing diseases. Modified live vaccine is the third type of canine distemper vaccine. CDV is modified so that it will not cause disease when injected into a naïve dog. However, the modified virus can still create antigenic reaction, causing the immune system to create antibodies against the virus. The last vaccine used for CDV is measles vaccine. Measles virus is from the same family as CDV, thus, having similar antigens. This vaccine is usually given to puppies that are about 3 to 4 weeks old.

CDV is an enveloped virus, therefore, it is unstable in environment. Consequently, CDV can be destroyed by heat that is above the body temperature. Also, disinfectant can be used to kill the CDV. Another way to prevent the spread of the virus is to isolate infected dogs. Infected dogs should be caged in a separate building that has its own air circulation system, so there will not be virus transmitted through the air vent.

Reference

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Pictures

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