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The following viruses are associated with clinical disease in the dog. Unfortunately is beyond the cope of his paper to cover all of them, or to go into detail with the rest.

- **Respiratory System**
  a. Adenovirus Type 2
  b. Parainfluenza Virus
  c. Influenza
  d. Reovirus

- **Gastro-intestinal tract**
  a. Calicivirus Infection (rare)
  b. Coronavirus Gastroenteritis (mild disease)
  c. Parvovirus Infection
  d. Parvovirus Type 1 Infection (rare)
  e. Rotavirus Infection (infrequent)
  f. Astrovirus
  g. Acidophil cell hepatitis

- **Skin**
  a. Papillomatosis
  b. Poxvirus

- **Multi-system Infections**
  a. Distemper
  b. Herpesvirus Infection (infrequent)
  c. Infectious Canine Hepatitis
  d. African horse sickness
  e. Rift valley fever

**Parainfluenzavirus (CPIV)**

CPIV is frequently isolated from dogs with an acute dry cough. CPIV affects the surface epithelium of the upper and lower respiratory tract, producing an acute inflammatory reaction that does not appear to persist in the dog. Clinical signs are often mild and include coughing, tonsillitis, and nasal discharge. With secondary bacterial infection, severe disease may develop.

**Type 2 Adenovirus (CAV-2)**

CAV-2 usually occurs in unvaccinated dogs and in pups that have lost their maternal antibody protection. CAV-2 can induce a very mild disease, or can produce a fatal bronchopneumonia. Clinical signs include fever, lethargy, and a dry cough of tracheal origin persisting for 10 - 15 days. In contrast to CPIV, CAV-2 seems to persist for long periods of time. Like CPIV, CAV-2 can cause a severe tracheo-bronchitis with mycoplasmas and secondary bacterial infections.

**Influenza (Influenza A subtype H3N8 virus)**
Canine influenza is a newly emerging and highly contagious respiratory infection of dogs. The virus is presumed to have been acquired from horses, as H3N8 virus is a frequent cause of equine influenza. Influenza was first reported in greyhounds in the USA in 2003 and manifested as a haemorrhagic pneumonia. Although the disease was first seen in race tracks it has since spread to veterinary clinics, boarding facilities and animal shelters. Infection is via the respiratory tract and spread is mainly by infectious aerosols resulting from coughing but also indirectly by fomites. The incubation period is 2 - 5 days and the course in uncomplicated cases is 1 - 3 weeks. The majority of affected dogs show mild disease with older dogs and puppies more severely affected. Among the clinical signs are fever, coughing, dyspnoea, anorexia, depression and mucoid to purulent nasal discharge. The severe, infrequent form is characterized by pneumonia with secondary bacterial infection. The fatality rate has ranged around 10%. Unfortunately canine influenza can only be distinguished from other respiratory infections by laboratory means. Diagnosis can be confirmed through serological testing for antibodies to canine influenza virus.

**Reovirus**

Lesions are often mild and confined to the lungs which show exudation of macrophages into alveolar spaces and diffuse thickening of alveolar septa. Experimentally infected dogs show mucoid nasal discharge, fever, and mild cough. Reovirus is not a significant aetiological agent of infectious tracheo-bronchitis.

**Calicivirus**

Although calicivirus has been isolated from dogs with glossitis and enteritis, its significance is not clear. Some isolates appear to be closely related to the feline calicivirus whereas others are more closely related to the San Miguel sea lion virus. Laboratory diagnosis involves isolation and identification of the virus from faeces and oral lesions.

**Coronavirus**

Coronavirus infection is a relatively mild enteric disease of mainly young dogs although all ages may be infected. The virus is shed in the faeces and the mode of infection is by ingestion and is common in kennels and colonies. Clinical signs are anorexia, depression, vomition, and diarrhoea and loose stools. A specific diagnosis can be made by finding the virus in faecal samples with the electron microscopy or using direct fluorescent antibody staining of faeces.

**Parvovirus**

Canine parvovirus infection is a contagious disease of dogs caused by canine parvovirus 2, which is closely related to the parvovirus causing feline panleukopenia. The disease is seen in household dogs and may involve whole litters and kennels. Young and elderly dogs and Doberman pinschers
and Rottweilers are most susceptible. Clinical signs include vomiting, haemorrhagic diarrhoea, fever, dehydration, and marked leukopenia.

**Parvovirus 1**

Canine parvovirus 1 causes infrequent enteric and respiratory infections in young puppies. A number of puppies in a litter may be infected and the outcome may be fatal. Clinical signs include dullness, anorexia, diarrhoea, vomiting and dyspnoea. Unless a Walter Reed canine cell line is employed for isolation or special immunological reagents employed, laboratory diagnosis is usually unsuccessful.

**Rotavirus**

Rotavirus occurs widely in the intestine of dogs but infections are generally subclinical, unlike the severe infection seen in the young animals of other domestic species. Rotavirus can be detected in faeces with electron microscopy.

**Louping Ill (Ovine Encephalomyelitis, flavivirus)**

This occurs in the UK, Europe and the Middle East. It is an acute, non-contiguous encephalomyelitis, principally of sheep and less commonly of cattle, other animals and humans. Dogs and particularly sheepdogs and hunting dogs in endemic areas, are occasionally infected. When encephalitis develops it can be fatal. The disease is transmitted by the sheep tick, *Ixodes ricinus*. Clinical signs include fever, ataxia, trembling, salivation, coma and death. Definitive diagnosis is based upon the isolation and identification of the virus.

**Pseudorabies (Aujeszky's Disease, porcine herpesvirus 1)**

Pseudorabies affects primarily swine and infrequently the dog. It is characterized by acute, fatal encephalitis. The disease is endemic in the swine of many countries and regions throughout the world. Dogs can become infected by direct contact with pigs that are shedding virus in nasal secretions or saliva and by eating pork. The disease is usually sporadic characterised by an intense pruritis at the external entry site of the virus followed by self-mutilation leading to acute fatal encephalitis. Clinical signs include changes in behaviour, anorexia, over excitement, pruritis, self-mutilation, paralysis and coma with death usually within 48 hours of the first signs. An important differential diagnosis is rabies.

**Rabies (Lyssavirus)**

Rabies is a fatal encephalitis of all warm-blooded mammals that manifests mainly in either a furious or dumb (paralytic) form. The infection usually originates in a bite wound and ascends a nerve trunk to the cord and brain. The incubation period is variable and, on occasions, has been longer than six months. The disease occurs worldwide except for Australia, New Zealand, the
British Isles, Hawaii, the Scandinavian countries, Cyprus and Japan. Variants of the classic rabies virus include Lagos bat virus (Africa), Mokola virus (Africa), Duvenhage virus (Africa), European bat virus 1 and 2 and Australian bat virus. Clinical stages of the disease include:

- Pro-dromal form characterised by anxiety, behaviour changes, and often severe pruritis at the site of exposure. This stage lasts from 1 - 3 days. Paralysis ensues rapidly and death occurs within 10 days after the first signs are seen.
- Furious form characterised by aimless wandering, excitement; irritability; bites or attempts to bite animals, people and inanimate objects (mad-dog syndrome); depraved appetite; voice altered; muscle paralysis, salivation, convulsions, ataxia, paralysis and death.
- Paralytic form, which is most common and is characterised by lethargic, muscular tremors, dysphagia, and terminal paralysis.

Diagnosis is made on fluorescent antibody, immunoperoxidase staining, and PCR of brain tissue.

**Wesselsbron (Flavivirus)**

Wesselsbron is a vector-borne disease reported in dogs that died from encephalitis. Antibodies to Wesselsbron disease have been detected in healthy dogs from Botswana and South Africa. The diagnosis is usually made retrospectively on post mortem examination. There is no specific therapy for the disease. It is possible that dogs showing transient non-specific signs of encephalitis may in fact be as the result of infection with Flaviviridae.

**Papillomatosis**

Canine papillomatosis, or warts, is a contagious disease of dogs that is characterized by the formation of benign tumours involving the skin and oral mucous membrane. Transmission is by direct and indirect contact. The infection begins as small papules, which enlarge to form small, cauliflower-like warts which may appear on the lips, tongue, gums, buccal mucosa and occasionally the conjunctivae. Although surgical excision is the treatment of choice, warts frequently disappear spontaneously within a few weeks.

**Distemper (Morbilivirus)**

Canine distemper is a highly contagious viral disease, usually of young dogs, characterized by profound involvement of the respiratory, gastro-intestinal and nervous systems. The virus is relatively labile and unstable outside the host. The disease can be endemic in urban areas. The mode of infection is inhalation and transmission is by direct contact and fomites. Large numbers of virus particles are shed in secretions and excretions during the active stage of the disease. Because of maternal antibody, many infections are sub-clinical. The incubation period is 3 - 7 days but may be as long as 4 weeks. Clinical signs include pyrexia, leukopenia, pneumonia, and gastroenteritis. Recovery
from the acute phase may be followed by neurological signs. The diagnosis can be suspected on clinical signs, and confirmed by means of viral demonstration, serology, and autopsy.

**Herpesvirus**

Canine herpesvirus infection is a contagious, often fatal disease of puppies usually under 3 weeks of age. The virus is carried by many adult dogs and puppies are usually protected by maternal antibodies. Infection of puppies is considered to take place transplacentally or by contact during or shortly after parturition. The disease in susceptible puppies is characterized by a viraemia with disseminated necrosis and haemorrhages involving the kidney, liver, and lungs. Clinical signs include diarrhoea, anorexia, dyspnoea, and abdominal pain. Mild rhinitis and conjunctivitis occurs in previously unexposed adults. In females the virus may cause vesicular vaginitis, abortion and infertility; whereas male dogs may show vesicular lesions on the penis and prepuce. Canine herpesvirus infection should be suspected in young puppies that have an acute, frequently fatal, febrile disease that does not respond to antibiotics. The diagnosis can be confirmed by virus isolation, fluorescent antibody staining of tissues and histopathology.

**Infectious Canine Hepatitis (Adenovirus 1)**

Clinical signs include anorexia, pyrexia, conjunctivitis, anasarca, vomition, diarrhoea, icterus, and abdominal pain. Some dogs can show CNS signs (disorientation, seizures, terminal coma). Epistaxis, petechial, and ecchymotic haemorrhages are often observed. There is often a transient, occasionally permanent, corneal opacity in one or both eyes (blue eye). Diagnosis is based on clinical signs, elevated liver enzyme activity, serology, and presence of characteristic inclusion bodies in liver, spleen and gall bladder sections.

**African Horse-Sickness (Orbivirus)**

In addition to equines, the dog is the only other species that can contract the virus, usually by ingesting infected horsemeat, but also by infected by vector borne transmission by Culicoides midges. Typical clinical signs include fever, cough and diarrhoea. The disease progression is often acute. Post mortem examination of affected dogs shows severe pulmonary oedema, pleural effusion, and splenomegally. Antibodies to African horse sickness have been detected in healthy dogs from Egypt, India, and South Africa.

**Rift Valley Fever (Phlebovirus)**

Rift Valley fever is transmitted by the Aedes mosquito, although midges, ticks, and sandflies can also transmit the infection. Direction transmission, by inhalation or ingestion, from affected animals is also possible. In young puppies’ infection with Rift Valley fever virus results in viraemia, hepatic and myocardial necrosis, meningitis, diffuse petechial haemorrhages, and death. Although adult animals do not succumb to the infection they can develop a viraemic state and infection in a pregnant animal can result in abortion or
stillbirths. The diagnosis is usually made retrospectively on post mortem examination.