

Paramyxoviruses

Paramyxoviruses are characterized by virions that are enveloped, pleomorphic and contain a genome of linear, negative-sense, single-stranded RNA. The envelope contains two transmembrane viral glycoproteins that form spikes projecting from the surface. The spikes are formed by the receptor-binding attachment protein (hemagglutinin (H) or hemagglutinin-neuraminidase (HN) and the fusion protein (F) that is essential for virus infectivity and for cell-to-cell spread.

Newcastle Disease

Newcastle disease (ND) is a highly contagious disease of chickens that is characterized by respiratory distress, diarrhea, and neurological signs. The severity of the disease is dependent upon the age and immune status of the birds, and on the virulence of the strain of ND virus that is responsible for the infection. The most virulent strains are designated as velogenic and produce mortality rates in affected birds as high as 90% or more. The disease caused by mesogenic strains is less severe and the mortality rate is often less than 25%. The lentogenic strains are relatively avirulent and are often used as vaccines. Differences in the virulence of individual strains of NDV are due to differences in the proteases used to cleave the fusion protein. Less virulent strains use proteases that are present in the respiratory and gastrointestinal tract, only, whereas more virulent strains use the more ubiquitously proteases. The very virulent (velogenic) strains cause very rapidly fatal infections involving the visceral organs or the CNS. Mesogenic strains of NDV cause respiratory and, occasionally, neurologic disease in infected chickens with low mortality, while lentogenic strains produce a mild or often inapparent disease.

Geographic Distribution and Transmission. Newcastle disease virus (NDV) infects chickens, turkeys, and a large number of species of domestic and wild birds. Humans accidentally infected with NDV when exposed to infected birds or live viral vaccines may develop a self-limiting conjunctivitis. Aerosol respiratory infection is the most common route for transmission of NDV. Infected birds begin to shed virus 2–3 days after exposure from their respiratory tracts and continue to shed virus for several weeks.

Laboratory Diagnosis

1. The clinical signs
2. NDV can be isolated by inoculating embryonated eggs or cell cultures with respiratory exudate or tissue suspensions
3. Serological diagnosis requires demonstration of rising NDV antibody titers by the hemagglutination inhibition or neutralization assay, or enzyme-linked immunosorbent assay (ELISA).
4. PCR, and sequence analysis to distinguish whether the virus is a velogenic field strain or a live vaccine strain.

Vaccination

Since there is only one serotype of NDV, vaccination with either inactivated or live virus vaccines is also used to prevent ND. The majority of live vaccines incorporate lentogenic strains of NDV administered in drinking water or applied as aerosols.

Coronaviruses

Coronaviruses have a unique morphologic appearance of a crown and the name “coronavirus” was derived from the Latin word *corona*, meaning *crown*. They are spherical, enveloped virions with large club-shaped surface projections (peplomers) extending from the viral envelope. The coronavirus genome is a single-stranded, positive-sense RNA molecule. The virus core is surrounded by a lipoprotein envelope that is derived from the intracellular membranes during virus budding from the cell. The S glycoprotein forms the large peplomers on the virion surface, giving the virus its corona or crown-like morphology when examined under the electron microscope.

Avian Infectious Bronchitis Virus

Avian bronchitis virus (IBV) is one of the most significant causes of economic losses within the poultry industry, affecting the performance of both egg-laying and meat-style (broiler) birds. Avian IBV causes respiratory disease in chicks 10 days to 4 weeks of age; however, all ages, sexes, and breeds are susceptible to infection although mortality is low in birds greater than 6 weeks of age. The virus replicates not only in the upper and lower respiratory tract but also in the alimentary tract (e.g., esophagus, proventriculus, duodenum, jejunum, cecal tonsils, rectum, cloaca, and bursa of Fabricius) and other tissues such as reproductive tract (e.g., oviduct and testes) and kidneys. The respiratory disease is characterized by respiratory distress, rales, coughing, nasal discharge, and depression. The clinical course lasts 6–18 days. Morbidity is 100% and mortality may exceed 25%. Chicks with no maternal antibody may experience permanent oviduct damage and fail to lay eggs when mature. Infection of the alimentary tract tissues does not manifest clinically. However, nephritis is not uncommon among some of the IBV

infected broilers. IBV-associated renal disease is dependent upon viral strain. Many viral strains with an affinity for the kidneys cause only mild or inapparent respiratory signs, but can cause substantial mortality in susceptible birds. Infection of laying flocks results in a drop of egg production and hatchability.

Etiologic Agent. Multiple distinct IBV strains have been identified. A small percentage of amino acid changes in the S1 protein can result in a change in virus neutralizing epitopes leading to emergence of new antigenic variants and serotypes. Thus, IBV variants may belong to over a hundred serotypes. Genotyping of IBV strains has been achieved primarily by RTPCR implication and sequencing of the S1 subunit of the spike glycoprotein, which is the major inducer of protective immunity and expresses most of the virus-neutralizing epitopes, including the serotype specific epitopes.

Distribution, Reservoir, and Transmission. A large number of IBV variants exist around the world. Interestingly, some of the IBV variants are unique to a particular area, whereas others have a more general distribution. The virus likely persists in persistently infected birds and/or continuous cycles of transmission. Virus has been recovered for up to 49 days from infected chickens held in isolation and for even longer periods in those held under natural conditions. Viral transmission occurs by inhalation, with the respiratory tract being the primary site of infection. Virus is shed in respiratory and fecal materials, with subsequent spread by contaminated fomites and aerosol.

Laboratory Diagnosis. Viral isolation is conducted by inoculation of tracheal or respiratory exudates into the chorioallantoic sac of 10- to 11-day-old embryonated chicken eggs (ECE). Recently, real-time RT-PCR assays for the detection of IBV nucleic acid have been described. Serologic diagnosis of IBV infection

requires paired serum samples and the use of IBV-specific viral neutralization, HI or ELISA assays.

Vaccination. Attenuated and inactivated vaccines have been developed for the control of IB. Inactivated vaccines induce neutralizing antibodies, but their efficacy has been questioned. Vaccines attenuated by serial passage in embryonated chicken eggs have not only reduced pathogenicity but also decreased immunogenicity. Vaccination with attenuated vaccines produce short-lived protection and start to decline after 9 weeks. Vaccines may be administered via aerosol or in drinking water. The multiplicity of IBV strains and serotypes has made it difficult to develop efficacious vaccines. No single strain has been identified as capable of inducing more than limited protection to heterologous viruses. Vaccines have not been developed commercially with nephropathogenic strains of IBV. Inactivated and subunit vaccines have been developed against IBV but they do not provide good protection against infection.

Turkey Coronavirus

Turkey Coronavirus is the causative agent of coronavirus enteritis of turkeys. It is an acute and highly contagious disease of turkeys of all ages and is of major economic importance to the turkey industry. Synonyms of the disease include blue comb disease, mud fever, transmissible enteritis, and infectious enteritis. The disease affects primarily the alimentary tract. Vaccines are not available.