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Newcastle disease of poultry

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Abstract
Poultry diseases are diseases that afflict poultry. Major types of poultry include the chicken, turkey, duck, goose and ostrich. The eradication of poultry disease is very important to the poultry industry.

Keywords: Newcastle disease, poultry, chicken

Introduction
Newcastle disease is a contagious viral bird disease affecting many domestic and wild avian species; it is transmissible to humans. It was first identified in Java, Indonesia, in 1926, and in 1927, in Newcastle-upon-Tyne, England (whence it got its name). However, it may have been prevalent as early as 1898, when a disease wiped out all the domestic fowl in northwest Scotland. Its effects are most notable in domestic poultry due to their high susceptibility and the potential for severe impacts of an epizootic on the poultry industries. It is endemic to many countries.

Exposure of humans to infected birds (for example in poultry processing plants) can cause mild conjunctivitis and influenza-like symptoms, but the Newcastle disease virus (NDV) otherwise poses no hazard to human health. Interest in the use of NDV as an anticancer agent has arisen from the ability of NDV to selectively kill human tumour cells with limited toxicity to normal cells.

Causal Agent
Description
The causal agent, Newcastle disease virus (NDV), is a variant of avian paramyxovirus 1 (APMV-1), a negative-sense, single-stranded RNA virus. NDV/APMV-1 belong to the genus *Avulavirus* in the family *Paramyxoviridae*. Transmission occurs by exposure to faecal and other excretions from infected birds, and through contact with contaminated food, water, equipment, and clothing.

Strains
NDV strains can be categorised as velogenic (highly virulent), mesogenic (intermediate virulence) or lentogenic (nonvirulent). Velogenic strains produce severe nervous and respiratory signs, spread rapidly, and cause up to 90% mortality. Mesogenic strains cause coughing, affect egg quality and production, and result in up to 10% mortality. Lentogenic strains produce mild signs with negligible mortality.

Use as an anticancer agent
In 1999, promising results were reported using an attenuated strain of the Newcastle virus, code named MTH-68, in cancer patients by researchers who had isolated the strain in 1968. It appears the virus preferentially targets and replicates in certain types of tumor cells, leaving normal cells almost unaffected. In 2006, researchers from the Hebrew University also succeeded in isolating a variant of the NDV, code named NDV-HUJ, which showed promising results in 14 glioblastoma multiforme patients. In 2011, Memorial Sloan-Kettering Cancer Center researchers found that NDV modified with the viral protein NS1 had a higher specificity for cancer cells that overexpressed the antiapoptotic factor Bcl-xL. The researchers suggested in cells that resist the normal inducement of apoptosis when infected will give NDV more time to incubate in cell and spread.

History of NDV in cancer therapy
Though the oncolytic effect of NDV was documented already in the 1950s, the main advances of viruses in cancer therapy came with the advent of reverse genetics technologies with these new possibilities, studies of modified NDV strains with enhanced cancer treatment properties have been put on the agenda. A study demonstrated the engineered Hitcher B1 NDV/F3aa strain could be modified to express a highly fusogenic F-protein in combination with immunostimulatory molecules such as IFN-gamma, interleukin 2 or tumor necrosis factor alpha. Promising results were discovered with proteins associated to the adaptive immune system, which paved the way for possibilities to use NDV to create a tumor-associated antigen. Another study showed how NDV/F3aa could be modified to express NS1, an influenza virus protein with capability to modulate with the innate immune response, for example, by suppressing the induction of the cellular interferons.

NDV, pros and cons in cancer therapy
NDV possesses many unique anticancer properties and thereby provides an excellent base in virotherapy research. NDV has selectivity on oncogenic cells, where it replicates without, or in a less pronounced way, harming normal cells. It binds, fuses into and replicates within the infected cells' cytoplasm independent of cell proliferation. One of the

main issues using NDV treatment is the host/patient immune response against the virus itself, which prior to the time of the reverse genetics technology, decreased the applicability of NDV as a cancer treatment.

Transmission

NDV is spread primarily through direct contact between healthy birds and the bodily discharges of infected birds. The disease is transmitted through infected birds' droppings and secretions from the nose, mouth, and eyes. NDV spreads rapidly among birds kept in confinement, such as commercially raised chickens.

High concentrations of the NDV are found in birds' bodily discharges; therefore, the disease can be spread easily by mechanical means. Virus-bearing material can be picked up on shoes and clothing and carried from an infected flock to a healthy one.

NDV can survive for several weeks in a warm and humid environment on birds' feathers, manure, and other materials. It can survive indefinitely in frozen material. However, the virus is destroyed rapidly by dehydration and by the ultraviolet rays in sunlight. Smuggled pet birds, especially Amazon parrots from Latin America, pose a great risk of introducing NDV into the US. Amazon parrots are carriers of the disease, but do not show symptoms, and are capable of shedding NDV for more than 400 days.

Clinical findings

Clinical signs

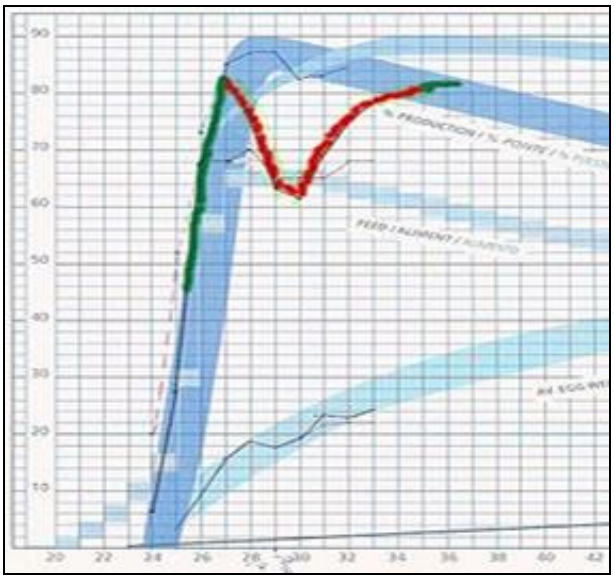

Fig 1

Egg drop after a (otherwise asymptomatic) Newcastle disease infection in a duly vaccinated broiler parent flock

Signs of infection with NDV vary greatly depending on factors such as the strain of virus and the health, age and species of the host.

The incubation period for the disease ranges from two to 15 days. An infected bird may exhibit several signs, including respiratory signs (gasping, coughing), nervous signs (depression, inappetence, muscular tremors, drooping wings, twisting of head and neck, circling, complete paralysis), swelling of the tissues around the eyes and neck, greenish, watery diarrhea, misshapen, rough- or thin-shelled eggs and reduced egg production.

In acute cases, the death is very sudden, and, in the beginning of the outbreak, the remaining birds do not seem to be sick. In flocks with good immunity, however, the signs (respiratory and digestive) are mild and progressive, and are followed after seven days by nervous symptoms, especially twisted heads.

Fig 2: Torticollis in a mallard

Fig 3: Same symptom in a broiler

Fig 4: PM lesions on proventriculus, gizzard and duodenum

Immunological tests
Enzyme linked immunosorbent assay (ELISA), PCR, and sequence technology tests have been developed.

Virus isolation
Samples
For routine isolation of NDV from chickens, turkeys, and other birds, samples are obtained by swabbing the trachea and the cloaca. Cotton swabs can be used. The virus can also be isolated from the lungs, brain, spleen, liver, and kidneys.

Handling
Prior to shipping, samples should be stored at 4 °C (refrigerator). Samples must be shipped in a padded envelope or box. Samples may be sent by regular mail, but overnight is recommended.

Prevention
Any animals showing symptoms of Newcastle disease should be isolated immediately. New birds should also be vaccinated before being introduced to a flock. An inactivated viral vaccine is available, as well as various combination vaccines. A thermotolerant vaccine is available for controlling Newcastle disease in underdeveloped countries.

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