# NEWCASTLE DISEASE

## AETIOLOGY

### Classification of the causative agent

Newcastle disease (ND) is a member of the family Paramyxoviridae in the genus *Avulavirus*. There are ten serotypes of avian paramyxoviruses designated APMV-I to APMV-10 and ND virus (NDV) has been designated APMV-1. NDV has also been categorised into five pathotypes based on clinical signs in infected chickens, designated: a) viscerotropic velogenic, b) neurotropic velogenic, c) mesogenic, d) lentogenic or respiratory and e) aymptomatic. Pathotype groupings are rarely clear-cut.

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| Temperature: | Inactivated by 56°C/3 hours or 60°C/30 minutes. |
| pH: | Inactivated by acid pH ≤ 2. |
| Chemicals/Disinfectants: | Ether sensitive; inactivated by formalin, phenolics and oxidising agents (e.g. Virkon®); chlorhexidine, sodium hypochlorite (6%). |
| Survival: | Survives for long periods at ambient temperature, especially in faeces. |

## EPIDEMIOLOGY

### Hosts

- Many species of birds both domestic and wild
    - Chickens are highly susceptible to disease; turkeys do not tend to develop severe signs
    - Game birds (pheasants, partridges, quail and guinea fowl) and parrots (order Psittaciformes) vary in susceptibility; cockatiels are susceptible
    - Wild birds and waterfowl (order Anseriformes) may harbour virus subclinically; some isolates within certain genotypes have caused epiornitics within these species
    - Young cormorants (*Phalacrocorax* spp.) have demonstrated disease associated with APMV-1
    - Disease has been recorded in ostriches (order Struthioniformes) and pigeons (order Columbiformes) are known to be susceptible
    - Raptors are usually resistant to ND; except reports of acute disease in bearded vulture (*Gypaetus barbatus*), white-tailed sea eagle (*Haliaeetus albicilla*), a wild osprey (*Pandion haliaetus*) and some species of falcons
    - Other birds known to have been affected by NDV include: gulls (order Charadriiformes), owls (order Strigiformes), and pelicans (order Pelecaniformes).
    - Passerine birds (order Passeriformes) are variable in their susceptibility; some species show no signs of disease but excrete NDV while others may develop severe disease
    - Reports of deaths in crows and ravens (genus *Corvus*) have been recorded
    - Acute ND has been recorded in penguins (order Sphenisciformes)
- The morbidity and mortality rates vary among species, and with the strain of virus
- Humans may become infected; manifested by unilateral or bilateral reddening, excessive lachrymation, oedema of the eyelids, conjunctivitis and sub-conjunctival haemorrhage

### Transmission

- Direct contact with secretions of infected birds; principally via ingestion (faecal/oral route) and inhalation
- Fomites: feed, water, implements, premises, human clothing, boots, sacks, egg trays/crates, etc.
    - Survival of agent is prolonged by presence of faeces; as in soiled egg shells
- Hatching chicks may be infected through egg for some NDV strains; transmission of highly virulent isolates is uncommon
- No clear evidence of role of flies in mechanical transmission

### *Sources of virus*

- Respiratory secretions/discharges and faeces of infected birds
- All parts of the carcass
- Virus is shed during the incubation period, during clinical stages and for a limited period during convalescence
- Wild birds and waterfowl may act as reservoir hosts for lentogenic pathotypes of ND; subsequently, these viruses could become virulent following mutation upon establishment in domestic poultry
- Some psittacine birds have been demonstrated to shed ND virus intermittently for over 1 year and been associated with introduction into poultry

### *Occurrence*

Velogenic NDV is endemic in areas of Mexico, Central and South America, widely spread in Asia, the Middle East and Africa, and in double-crested wild cormorants in the US and Canada. Lentogenic strains of NDV are worldwide in their distribution while widespread mesogenic pathotypes with a special adaptation to pigeons (i.e. pigeon paramyxovirus) do not appear to infect other poultry readily.

## *DIAGNOSIS*

Incubation period is 2–15 days with an average of 5–6 days; some species may be over 20 days. For the purposes of the OIE *Terrestrial Animal Health Code*, the incubation period for ND is 21 days.

### *Clinical diagnosis*

Clinical signs seen in birds infected with NDV vary widely and are dependent on factors such as: the virus/pathotype, host species, age of host, co-infection with other organisms, environmental stress and immune status. Clinical signs alone do not present a reliable basis for diagnosis of ND. Morbidity and mortality depend on virulence of the virus strain, degree of vaccinal immunity, environmental conditions, and condition of the flock.

**Lentogenic strains**

- Usually associated with subclinical disease marked by mild respiratory disease; coughing, gasping, sneezing and rales
- If other co-infectious agents circulating, can result in severe signs
- Mortality is negligible

**Mesogenic strains**

- May produce cause acute respiratory disease and neurologic signs in some species
- Mortality rate is usually low (<10%)
- If other co-infectious agents circulating, can result in severe signs

**Velogenic strains**

- Most commonly cause severe disease in chickens with mortality; signs principally respiratory and/or nervous
- Initial clinical signs vary but include: lethargy, inappetence, ruffled feathers, oedema and injection of conjunctiva.
- As the disease progresses birds may develop: greenish or white watery diarrhoea, dyspnoea and inflammation of the head and neck often with cyanotic discoloration

- In later stages of disease neurologic signs may be manifested as: tremors, tonic/clonic spasms, wing/leg paresis or paralysis, torticollis, and aberrant circling behaviour; also be seen
- Sharp drop in egg production; eggs contain a watery albumin and appear misshapen with abnormally coloured, rough or thin shells
- These strains often result in sudden death, with few or no signs
- Birds that survive serious infection may develop neurologic and partial or complete cessation of egg production
- Morbidity and mortality rates may approach 100% in unvaccinated chickens

### *Lesions*

There are no pathognomonic gross lesions; several birds must be examined to determine a tentative diagnosis and final diagnosis must await virus isolation and identification.

- Only velogenic strains produce significant gross lesions
- Lesions that may be found include:
    - swelling of periorbital area or entire head
    - oedema of the interstitial or peritracheal tissue of the neck; especially at the thoracic inlet
    - congestion and sometimes haemorrhages in the caudal pharynx and tracheal mucosa; diphtheritic membranes may be evident in the oropharynx, trachea and oesophagus
    - petechiae and small ecchymoses on the mucosa of the proventriculus, concentrated around the orifices of the mucous glands
    - oedema, haemorrhages, necrosis or ulcerations of respiratory/digestive lymphoid tissue, including cecal tonsils and Peyer's patches;
        - though not pathognomonic, ulceration/necrosis of Peyer's patches is suggestive of Newcastle disease
    - oedema, haemorrhages or degeneration of ovaries
    - although less evident in older birds, haemorrhages of the thymus and bursa of fabriceus may occur
    - spleen may appear enlarged, friable and dark red or mottled
    - some cases may present pulmonary oedema and pancreatic necrosis

The OIE will periodically update the OIE Technical Disease Cards. Please send relevant new references and proposed modifications to the OIE Scientific and Technical Department (scientific.dept@oie.int). Last updated April 2013.