



Newcastle Disease (ND)

Extended Version

Classic case: Gasping, facial edema ('square head'), paralysis, ↓ egg production, sudden death

Presentation: Acute, highly contagious, **respiratory** and **neurologic** disease of **ALL** avian species

- Poultry (**CHICKENS, young**) most seriously impacted
- Wide range **clinical signs** dependent on strain, predilection & virulence
 - From peracute w/ almost **100% mortality**
 - To subclinical w/ **NO** lesions

Five strains grouped by pathotype

1. Viscerotropic velogenic Newcastle disease (VVND): Reportable

- Highly virulent, ~100% mortality in 2-3 days
- Respiratory
 - Marked gasping, coughing, wheezing
 - Sneezing, nasal discharge
 - Facial edema- 'Square head'
 - Reddened lower eyelid (over lymphoid patch)
- Neurologic (encephalitis)
 - Muscle tremors, droopy wings, opisthotonus, circling, paralysis, torticollis
- Digestive
 - Inappetence, violent watery green diarrhea
- Depression, fever, ruffled feathers
- **Decreased** egg laying
 - **Eggs:** thin shells, watery albumen,
 - Abnormal color, shape
- **Sudden death**

2. Neurotropic velogenic: Reportable

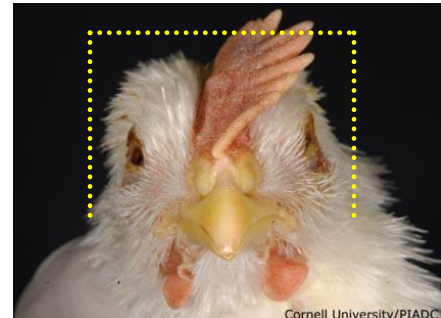
- Highly virulent, ~100% morbidity, 50% mortality
- +/- Respiratory signs followed by neurological signs
 - Muscle tremors, droopy wings, opisthotonus, circling, paralysis, torticollis
 - *Bright & alert* even with severe nervous signs
 - Will eat if able to reach food

3. Mesogenic: Reportable

- Moderate virulence, low mortality
- **Young** chicks (up to 50% mortality)
 - Gasping, coughing, hoarse chirping
 - Ataxia, 'star gazing'
- **Adults**
 - Mild depression & **respiratory signs**, nervous signs (rare)
 - **Decreased** egg production, Abnormal eggs
 - Increased morbidity due to secondary infections



*Newcastle respiratory signs:
Coughing and gasping*



*Bilateral facial edema 'Square head'
VVND*



*Torticollis
Neurotropic velogenic Newcastle*



Newcastle Disease (ND)

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Presentation: Five strains grouped by pathotype (continued)

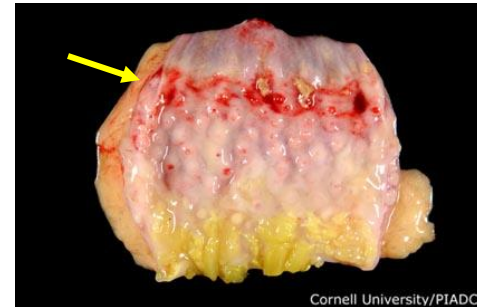
4. **Lentogenic:** NOT reportable Used for **modified-live vaccines**
 - Low virulence, RARELY causes disease in adults
 - Mild or subclinical respiratory infection
 - **Decreased** egg production
5. **Asymptomatic enteric:** NOT reportable
 - Subclinical enteric infection

DDX:

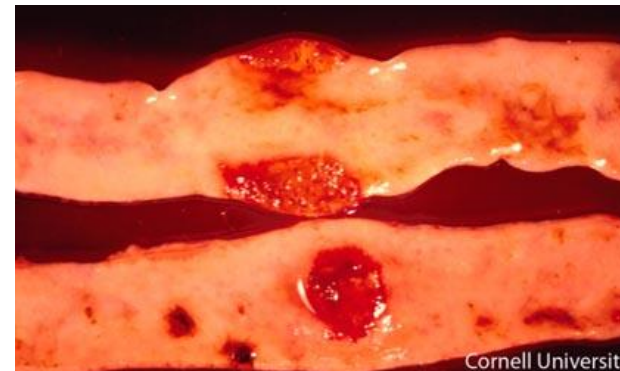
Avian influenza, fowl cholera, infectious bronchitis, ILT

Test(s) of choice: Reportable disease

- **Field Diagnosis-** Clinical signs, necropsy
- **Necropsy**
 - **Viscerotropic velogenic-** Remarkable gross lesions
 - **Almost pathognomonic** - Multifocal, necrosis, hemorrhage intestinal mucosa, especially at lymphoid foci (cecal tonsils)
 - Hemorrhage & necrosis of **lymphoid organs**
 - Spleen, GALT, cecal tonsils, thymus, laryngeal tonsils
 - Edema, hemorrhage, petechiations, ecchymoses
 - Serous membranes, mucosa
 - Proventriculus, intestines, eyelid, comb, wattle
 - Cranial trachea (laryngeal tonsils), peri-thymic region
 - Severe atrophy of thymus and bursa of Fabricius
 - **Neurotropic velogenic-** NO gross lesions
 - **Mesogenic and Lentogenic-** Minimal gross lesions
 - Lesions primarily due to secondary bacterial infections
 - Mild tracheal and pulmonary hemorrhages
 - Splenomegaly
 - Respiratory tract congestion & mucoid exudate
 - Cloudy, thickened air sacs



Proventriculitis w/ hemorrhages concentrated at esophageal-proventricular junction. Common finding. VVND



Multifocal, necrosis & hemorrhage of intestinal mucosa, especially at lymphoid foci (cecal tonsils).

Almost pathognomonic for VVND



Splenic edema and necrosis (white spots), VVND

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Test(s) of choice: (continued)

- **Histopathology**
 - **Viscerotropic velogenic**
 - Severe necrosis & depletion of all lymphoid tissues
 - **Neurotropic velogenic**
 - Cerebellum (molecular layer) - gliosis
 - Lymphoid depletion
 - Myocarditis
 - **Mesogenic** **MOST** severe CNS lesions in **Pigeon-isolated strains**
 - Cerebellum & medulla oblongata (primarily)- encephalitis
 - Myocardial, splenic, pancreatic necrosis
 - **Lentogenic**- Minimal changes
 - Hyperplasia- lymphoid follicles, spleen, lungs, air sacs, trachea
 - Respiratory tract- deciliation, congestion, edema, goblet cell hyperplasia, squamous metaplasia in proximal trachea
- **Virus isolation: “Gold Standard”**
 - Prescribed test for international trade (OIE)
 - Using chick embryos or cell culture
 - Tested for hemagglutination activity (HA) on chicken erythrocytes
 - **Positive HA** - key feature of NDV and Avian Influenza
 - Infectious bronchitis = **negative** HA
 - Helps *differentiate* diseases
 - **IF** positive HA
 - **Hemagglutination inhibition (HI)** tests- ID pathotype & genotype
 - **RT-PCR, nucleotide sequence analysis, monoclonal antibodies**- detects genetic differences to compare with past outbreaks & ID source of infection
 - Specific amino acid motif of fusion (F protein) “notifiable” to OIE due to virulence
- **ICPI (intracerebral pathogenicity index) test**
 - Most sensitive, widely used test for measuring virulence
 - Measured by rapidity of killing day-old chicks inoculated intracerebrally
 - ICPI ≥ 0.7 is considered virulent or “notifiable” to the OIE



Severe acute hemorrhage & congestion of ovarian follicles. Leads to abnormal eggs & decreased laying.

Dr. Jaime Ruiz



Cornell University/PIA

Lung congestion and edema
VVND

Rx of choice: NO treatment

- **CULL** all birds on premises of NDV outbreak



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Prognosis:

- High losses with devastating economic ramifications
 - High mortality (with highly virulent strains like VVND)
 - Trade restrictions
 - Decreased production
 - Culled poultry flocks

Prevention:

- Vaccination:
 - **DOES NOT** fully protect against NDV
 - Can **obscure** signs of NDV resulting in further spread
 - Modified-live lentogenic vaccines:
 - Mass application
 - Drinking water (chicks)
 - Coarse spray (hatchery)
 - Individual administration
 - Nares
 - Conjunctival sac
 - Contraindicated in pigeons
 - Oil-adjuvanted killed vaccines:
 - Safe in pigeons
- **Strict biosecurity and strict sanitation protocols**
- **"All-in, All-out" flock management**
- **Prevent healthy birds from contact w/ sick birds or wild birds**
- **Only incubate eggs from clean flocks**
- **Enforce stringent importation laws**



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Non-poultry avian species (e.g. pigeons, parakeets, parrots) usually resist early lethal infection & develop chronic neurologic disease instead.

Neurologic signs predominate regardless of pathotype. This bird is exhibiting torticollis

Pearls:

- Newcastle disease virus (RNA virus): **Avian Paramyxovirus Serotype 1 (APMV-1)**
- **Strain variation-** differences in surface glycoproteins
 - Hemagglutinin-neuraminidase (**HN**)
 - Fusion (**F**)
- Virus **shed** during incubation, clinical stage, AND convalescence
- Viable in environment for **weeks**
 - Feathers, secretions, droppings
 - Survives indefinitely in frozen material
 - Rapidly destroyed by dehydration & UV rays
 - Present in eggs laid during clinical disease



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Pearls: (continued)

- Sometimes called “Exotic Newcastle disease” (END)
- **Transmission:** high levels of virus in body secretions
 - **Direct contact**
 - Bird to bird
 - Contaminated food, water, feces
 - **Airborne**
 - **Fomites**

ZOONOTIC

- NDV can produce **transitory conjunctivitis in people**
 - Lab workers & vaccination teams (high exposure to virus)
 - Poultry processing crews (less common due to vaccination)



Transitory conjunctivitis in humans exposed to large amounts of NDV

Refs: Cattoli et al, Newcastle Disease: Field Recognition & Current Methods of Laboratory Detection J Vet Diagn Invest, 2011, 23:637; USDA National Veterinary Accreditation Guide, Lohmann Animal Health; Cornell University Atlas of Avian Diseases; and Merck Manual, 10th ed (online): Newcastle Disease.
Images courtesy, Atlas of Avian Diseases, Cornell University

My Notes: