Newcastle Disease

- Many strains of similar virus cause signs ranging from mild respiratory signs (pneumotropic) with low mortality to severe neurological (neurotropic) and/or visceral lesions (viscerotropic) with heavy mortality
- Affects most domestic fowl as well as many wild and pet type birds
- May cause conjunctivitis in humans

Etiology

- Paramyxovirus type 1 = Newcastle disease.
  - There are 9 types of paramyxovirus.
- Single stranded RNA virus.
- The fact that this virus naturally hemagglutinates red blood cells is used in a simple differential diagnostic test. All paramyxoviruses will hemagglutinate RBC's.
- Virus can survive in dust and survives well in organic materials.

Etiology (Cont.)

- Virus has strains that differ in pathogenicity. The Mean Death Time (MDT) of embryos and the Intracerebral Pathogenicity Index (ICPI) are used to differentiate among the pathotypes.
- Enzootic strains are of low virulence and their technical designation is paramyxovirus type 1, but are still referred to as Newcastle disease virus.

Etiology (Cont.)

- **Lentogenic** - mild - kills embryos in > 90 hours
  - All enzootic strains in U. S. poultry are lentogenic
- **Mesogenic** - moderate - kills embryos in 60-90 hours
  - Mesogenic strains do not occur in U.S. poultry
- **Velogenic** - highly virulent neurotropic or viscerotropic - kills embryos in < 60 hours
  - Velogenic strains are now officially designated as Exotic Newcastle Disease (END)

Etiology (Cont.)

- Lentogenic & mesogenic are used as vaccine strains.
  - Hitchner: B1 - B1 - milder
  - La Sota: B1 - La Sota - more virulent.

Etiology (Cont.)

Exotic Newcastle Disease (END)

- ICPI of 0.7 or greater
- Synonyms: Velogenic Viscerotropic Newcastle Disease (VVND), Asiatic Newcastle Disease
- Not in the U.S. or Canada at present.
- Caused very costly outbreak in California in early 1970's which cost $54,000,000 to eradicate
- 2002 California outbreak and numerous instances in pet birds have been stamped out

Method of Spread

- Aerosol from infected bird excretions
- Mechanical vectors
- Vaccination is done with mild viruses, but this keeps mild forms of the disease endemic in commercial poultry producing areas.

Method of Spread (Cont.)

- Exotic Newcastle has brought into this country in smuggled pet birds and game fowl
- These introductions caused the California outbreaks
- There have been many other introductions of this virus into this country but fortunately the pet birds have not come in contact with commercial poultry flocks.

Method of Spread (Cont.)

- There are about 100 quarantine stations where pet birds are held when imported into the U.S.
- There has been no recorded incidence where pet birds that were released from these stations caused the dissemination of NCD.
- The greatest threat is smuggled pet birds.

Mortality

Enzootic ND

- Lentogenic & Mesogenic -
  - Usually negligible but can be complicated with other infections and cause up to 30% mortality.
- Velogenic -
  - Variable up to 50% in adults and 90% in chicks.

Mortality (Cont.)

Exotic ND (END)

- VVND -- up to 90-100% mortality in poultry -- much less in non-gallinaceous birds.

Mortality (Cont.)

- Most problems in commercial poultry in U.S. are caused by vaccinal strains acting as stressors causing secondary infection such as *E. coli* airsacculitis.
- Mortality will vary depending on severity and virulence of secondary invaders.

Signs

Young Chickens

Enzootic ND

- Sudden onset with depression & prostration. Respiratory signs such as gasping, coughing, rales and nasal discharge, necrotic comb.
- CNS signs closely follows respiratory signs. Twisted heads and "Stargazers". Usually less than 25% have CNS signs - opisthotonus. This occurs with either neurotropic or pneumotropic strains.
- Mortality depends on virulence of strain. May be up to 95%.

Conjunctivitis

Nervous Signs

Signs (Cont.)

Adult Chickens

Enzootic ND

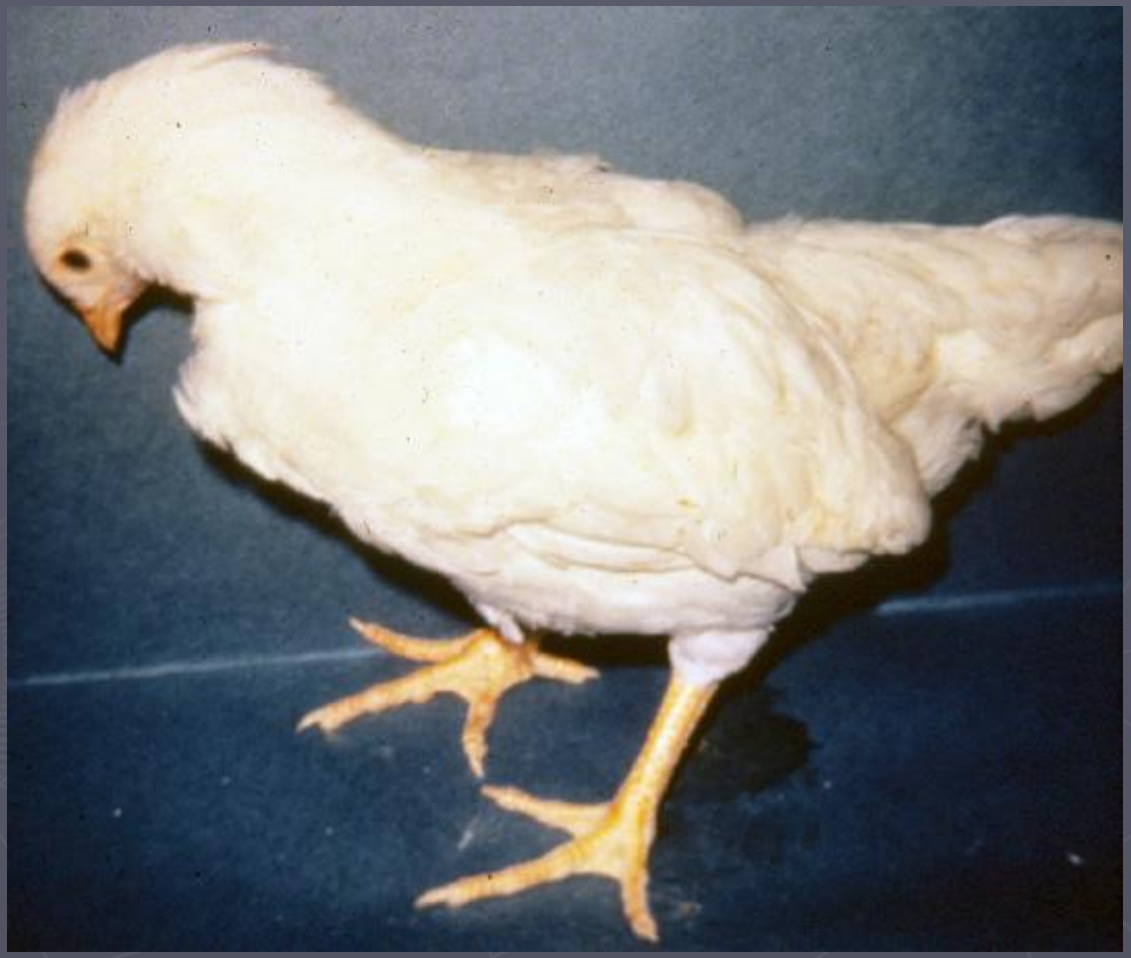
- Sudden onset with mild depression and anorexia. Respiratory disease may be mild and mortality is low or absent.
- CNS signs are few.
- Layers may cease to produce. Eggs that are laid are low quality and rough or soft shelled - similar to IBV.

  Production may or may not return - depending on stage of lay.

Egg Shell Malformation

Turkey Eggs

CNS Signs



Signs (Cont.)

Exotic ND (END)

Young and Adult Chickens

- Marked dyspnea
- Violent diarrhea (blood stained)
- Swollen head and throats
- Conjunctivitis
- Paralysis and death in 2 to 3 days

Signs (Cont.)

Turkeys

- Usually mild to moderate respiratory signs.

Postmortem Lesions

ENZOOTIC NCD

- Inflammation of the trachea and air sacs
- May be no gross lesions

Postmortem Lesions (Cont.)

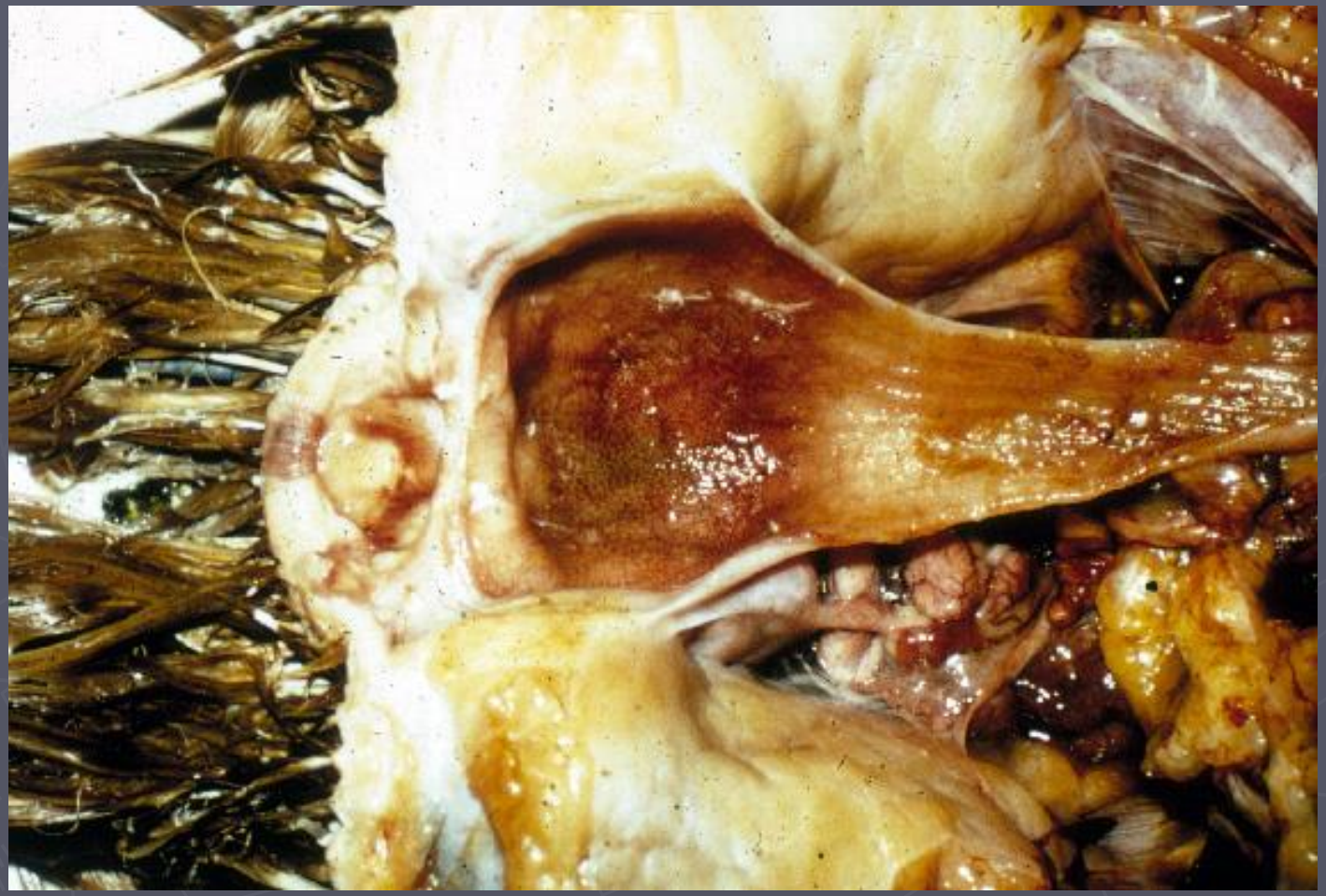
Exotic ND (END)

- Severe inflammation of trachea and air sacs
- Hemorrhagic or necrotic foci in mucosa of gut and cecal tonsils
- Severe hemorrhages of mucosal surface of the proventriculus and isthmus of gizzard. Cloacal hemorrhage
- Pet bird may have mild non-specific lesions and no gross lesions. (Can have severe enteric type)
- CNS histopathological lesions are present but must be differentiated from AE and MD

SQ Hemorrhage

Cecal Tonsil

Cloaca



Proventriculus

Differential Diagnosis

- Infectious bronchitis - respiratory
- Laryngotracheitis - respiratory
- Avian encephalomyelitis - neurological
- Vitamin E & selenium deficiency - neurological
- Mycotic encephalitis - neurological
- Avian influenza - variable pathogenicity

Diagnosis

- History
- HI
- VN - with known ND antisera
- Immunofluorescence
- ELISA
- Paired HI test on acute and convalescent sera

Diagnosis (Cont.)

- Isolation and identification of the virus. Hemagglutinating virus. Tracheas are the organ of choice for virus isolation.
- Virus neutralization with ND antiserum. In cases of mixed viral respiratory infection, NDV will show up in the embryos before IBV.
- Reproduce disease in susceptible chickens with virus.

Treatment

- None
- Broad spectrum antibiotics for secondary bacterial involvement

Prevention

Enzootic ND

Vaccination:

- **Live Virus**
  - B1 B1
  - VGGA (Glisson/ Villegas), vaccine developed at UGA, has reduced vaccinal reaction
  - La Sota
- **Killed Virus** in oil adjuvant, produced with B1 virus.

  Maternal antibodies interfere with active immunity buffering the expected vaccine reaction.

Prevention (Cont.)

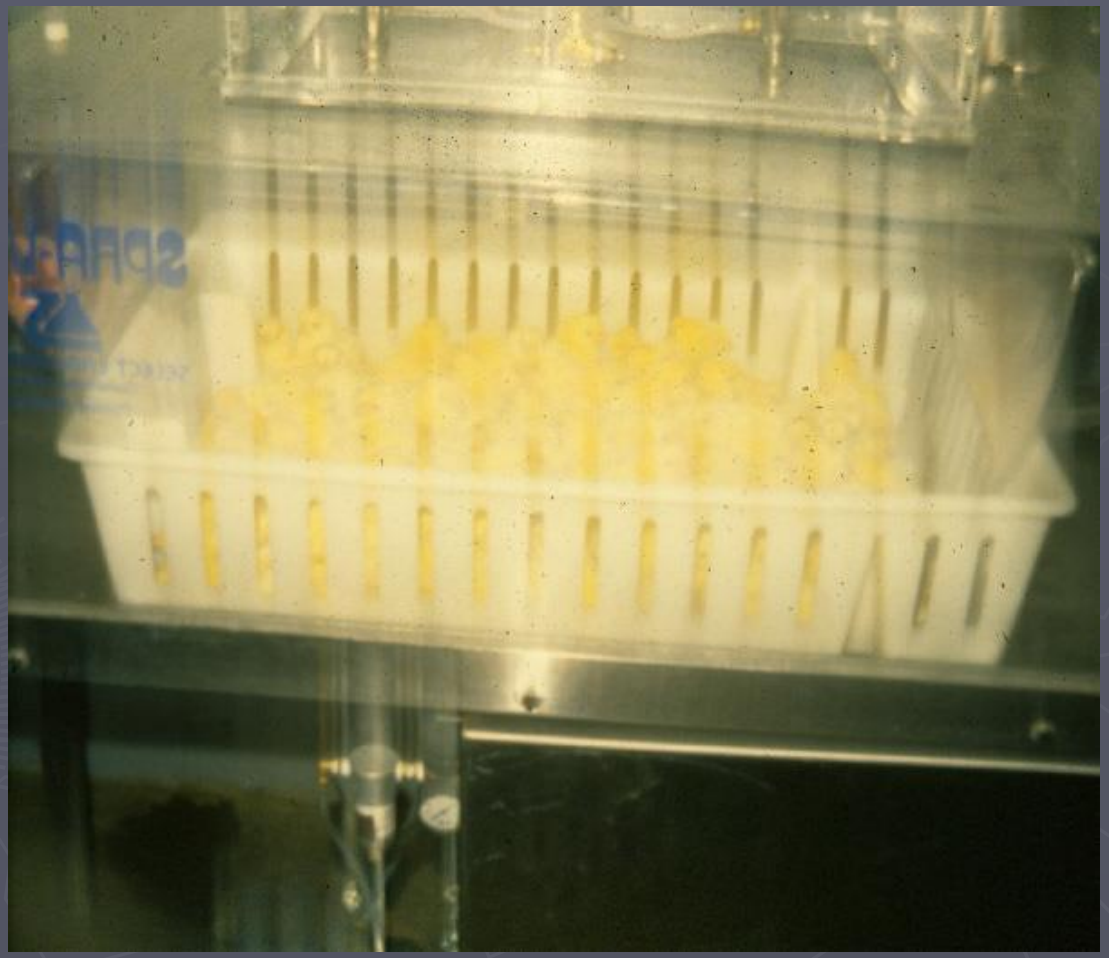
Enzootic

Immature Birds - broilers, leghorn pullets, etc. Vaccinated with live vaccines usually at 1 to 4 days and at around 14 to 28 days.

This virus doesn't replicate in the Harderian gland, so lower maternal antibody is desired to prevent vaccine blockage.

Breeders & Leghorns - give killed vaccine at around 12-18 wks. of age after being primed with live vaccine.

Vaccination Cabinet



Aerosol Vaccination

Prevention (Cont.)

Exotic ND

- Eradicated in the U.S. by massive slaughter in early 1970's and again in 2002
- Vaccination not allowed
- Vaccinated for in foreign countries using more potent vaccines than are used in the U.S. Greater vaccine virulence causes more severe vaccine reactions.
- Requires multiple vaccination programs and success is limited.

Conjunctivitis