

Department of Animal Science

NEWCASTLE DISEASE IN BACKYARD FLOCKS

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The number of backyard chicken enthusiasts has exploded in recent years, particularly since the start of the COVID-19 pandemic. Mail order hatcheries and feed stores across the country have seen sales of chicks to first-time customers expand tremendously. Tennessee is no exception to this backyard chicken interest explosion. However, this unprecedented increase in new backyard chicken owners could increase the risk of one of the deadliest poultry diseases known – Newcastle disease. Serious disease outbreaks are recognized as one of the poultry world’s greatest vulnerabilities because these outbreaks have the potential to impact not only small backyard flocks but also the multi-billion-dollar U.S. commercial poultry industry and even the entire U.S. economy if trade restrictions and lost export markets are involved. Newcastle disease virus (NDV) is a rapidly spreading, acute viral disease that affects domestic poultry (chickens and turkeys) and many other birds. NDV was first discovered in the late 1920s, first in Indonesia, and subsequently in 1927, in Newcastle-on-Tyne, England, where the disease gets its name. However, some researchers believe it may have existed as early as 1898, when Scotland’s entire population of domestic poultry was wiped out.

Symptoms

The pathogenicity of NDV strains varies greatly depending on the host, the type of virus, and how much virus the bird is exposed to. The **disease has similarities to avian influenza** in that chickens are highly susceptible, while ducks and geese can be infected and show few or no clinical signs to the same strain of NDV. The various strains of NDV are designated according to species serotype or the type of bird from which the virus was isolated; the geographical location of the isolation (state or country); and the reference number or name/year of the isolation. To date, there have been multiple strains isolated worldwide.

Symptoms of NDV vary according to the age of the bird and the form of the virus involved. However, there are often three major symptoms present:

1. **Respiratory difficulty** (gasping for breath, coughing and sneezing)
2. **Nervous disorders** (twisting of the head and neck, circling, tremors and paralysis)
3. **Reduction in egg production and eggshell quality.**

Other symptoms may include:

1. Sudden increase in death loss (possibly with no previous symptoms being noticed)
2. High mortality rates
3. Droopy wings
4. Depression
5. Loss of appetite
6. Green, watery diarrhea
7. Muscle spasms

The virus will localize in the respiratory tract, and in most cases, all affected birds show evidence of respiratory distress. However, should birds be infected with virulent Newcastle Disease (once known as Exotic Newcastle Disease), this virus is so deadly that many birds may die without ever showing signs of illness. If nervous symptoms are present, these tend to occur later in the outbreak, rather than earlier. Nervous symptoms usually occur only in younger birds – older birds rarely display nervous symptoms. Egg production and eggshell quality deteriorate rapidly in laying hens that become infected.

There are three forms of Newcastle disease: 1) lentogenic (mild), 2) mesogenic (moderate), and 3) velogenic (very virulent).

1. **Lentogenic** ND is characterized by mild pathogenicity associated with mild respiratory difficulty. Lentogenic strains are very widespread but seldom cause disease outbreaks. All ages of birds may have unnoticed infections. However, egg production drops in laying hens, and eggshell quality rapidly deteriorates.
2. **Mesogenic** ND is the most common type of Newcastle disease in the U.S. It is characterized by intermediate pathogenicity and respiratory and nervous symptoms in young chicks but not in older birds.
3. **Velogenic** (or field type) ND is very highly pathogenic. It is characterized by acute, sudden onset and is often fatal. Morbidity rates are quite high. There may be evidence of nervous system issues (twisted necks, paralyzed wings and legs, tremors, etc.) and respiratory difficulty.

By far, the most dangerous strain is velogenic viscerotropic Newcastle disease (virulent Newcastle [vND]). Because of the severe economic consequences connected to an outbreak of vND in the commercial poultry industry, vND, similar to avian influenza, is listed by the World Organization for Animal Health (WOAH) as a reportable disease. Since vND has a very high pathogenicity, outbreaks of the disease can cause large losses in a very short period of time. The disease is highly virulent with very high mortality. It can infect and cause death even in ND-vaccinated poultry, therefore **vaccination does not completely prevent infection**. Although commercial poultry flocks are vaccinated against ND, vaccines will not protect flocks against vND. The mortality rate may approach 100 percent if vND gets into a flock of vaccinated chickens or turkeys. Between May 17, 2018, and May 31, 2020, USDA confirmed 476 positive premises in California as infected with vND, including four commercial premises. A much larger outbreak of vND in California in 2002 quickly spread to the commercial industry from flocks of illegally imported game fowl. More than 3.5 million birds at over 2,100 sites in the U.S. were affected, and it took health officials over a year to eradicate it, at a cost to the federal government of more than \$180 million.

Respiratory and nervous signs are often less evident with vND because the birds die rapidly before showing signs of illness. The incubation period for the disease varies from two to 15 days, with the incubation period in chickens being 2-6 days. The disease is very contagious. Virtually 100 percent of the birds will be infected in 2-6 days when the virus is introduced into a susceptible flock. It appears that chickens and turkeys are most likely to be infected by other chickens and turkeys that have been infected, despite the fact that a wide variety of bird species can become infected.

Look for lesions associated with vND that may include swelling around the eyes and neck, hemorrhages on the mucosal surface of the trachea, small hemorrhages on the inside lining of the proventriculus (Figure 1A and 1B; Onyema et al., 2019), hemorrhages and necrosis of the lymphoid tissue in the intestines, nasal discharge, and thin-shelled, misshapen eggs. Be aware, the symptoms and lesions associated with vND are not exclusive to vND and, therefore, must be differentiated from other diseases with similar symptoms such as fowl cholera and avian influenza. This will require the **assistance of a diagnostic lab** that can perform virus isolation and identification to confirm a diagnosis because vND can present a clinical signature very similar to avian influenza.

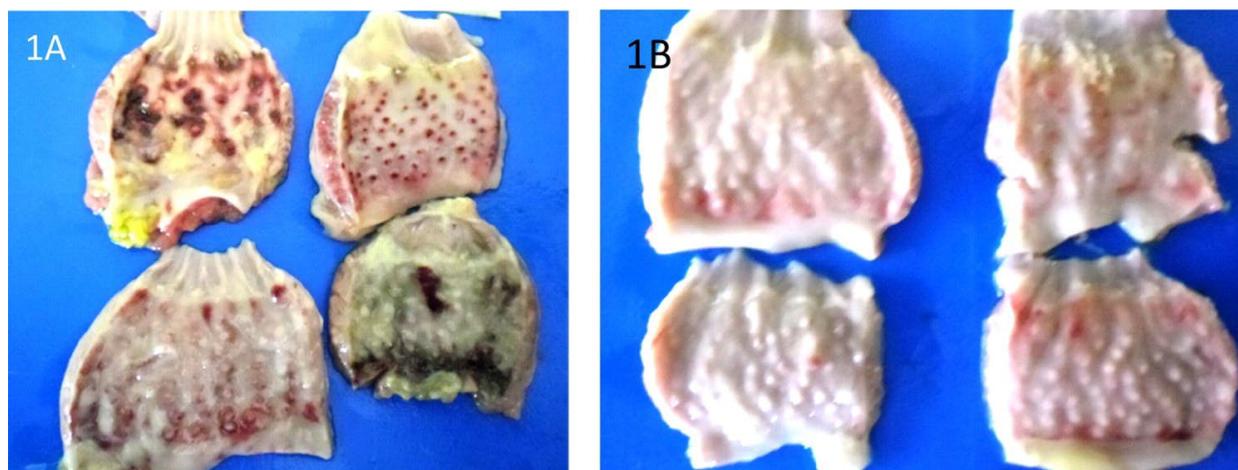


Figure 1. (A) Proventriculus of vNDV infected broilers showing severe mucosal hemorrhages on day four post inoculation. (B) Proventriculus of vNDV infected pullets showing mild mucosal hemorrhages on day four post inoculation. Source: Onyema et al., 2019.

Transmission

Newcastle disease virus is **expelled from the respiratory tract as an aerosol and excreted in the feces**. As a result, the virus is easily spread and, again, the disease is highly contagious. Newcastle disease virus has an affinity for red blood cells. Therefore, the virus is present in all parts of the carcass of an infected bird. Several methods of transmission exist, including the following:

- Direct contact with infected birds, feces or other body secretions.
- Through the air. Coughing and sneezing from infected birds contaminate the surrounding air with virus particles that quickly travel from bird to bird.
- Contaminated equipment, clothing, footwear, etc. This is likely the major means of transfer of the virus to uninfected flocks or farms. The Newcastle disease virus is quite

hardy and can easily survive on human hands, clothing and footwear. The virus can also survive in the environment for several weeks or longer, especially in periods of cooler weather. However, vND is sensitive to most disinfectants and can be inactivated if proper cleaning is done beforehand. Therefore, prior removal of organic matter, feathers, feces, etc., is critical to any disinfection program. Disinfectants will not work in the presence of organic matter. You cannot disinfect organic matter.

- Wild birds or neighboring poultry that may be infected. Waterfowl (ducks and geese) are carriers and are able to infect other birds while showing no symptoms themselves.
- Exotic birds (parrots and other members of the parrot family) are also carriers.
- Predators can spread the disease from one farm to another or from wild birds to farms.
- Failure to clean and disinfect properly. Backyard poultry operations that hatch and start chicks on a regular basis and keep several ages of birds on the farm at once can never adequately clean and disinfect an infected facility. As a result, older birds often infect younger birds. “All in, all out” management programs can help break the cycle of infection and allow for adequate cleaning and disinfection.

Biosecurity

The best way to protect your birds is with a strong biosecurity program. Biosecurity practices, for the most part, are often simple common sense. These include the following:

- Post “No Visitors” and “Restricted Area” signs at the driveway entrance.
- Restrict traffic flow (people and vehicles) onto and off your property. Do not allow visitors to your farm and do not visit other farms where poultry are located.
- Dedicate footwear/clothing to use when working in/near your flock.
- Maintain an effective rodent control program.
- Clean and disinfect all coops, crates and other poultry containers or equipment before and after use. Use plastic or metal containers, not wood; wood is difficult to clean and likely impossible to disinfect.
- If a bird becomes sick, do not move the other birds off the property, even if they appear healthy. Isolate any bird showing symptoms from the rest of the flock.
- All people entering poultry facilities should use footbaths. Footbaths should be changed regularly to maintain effectiveness.
- Wash hands and use hand sanitizers before and after visiting your birds.
- Remove or beware of standing water sources. Standing water can attract migrating waterfowl, which can carry vND virus without showing clinical signs of the disease.
- Purchase feed from a trusted source and keep it safe from wild birds and rodents. Clean up feed spills immediately. NDV can be transmitted via contamination of feed with infected feces.
- Do not share equipment with friends or neighbors. If you do, make sure it is cleaned and disinfected before it leaves and again before it returns home.
- Isolate any new birds or any returning birds from fairs, shows, swap meets or auctions for 30 days before placing them with the rest of the flock.
- Do not mix young and old birds or birds from different species (particularly chickens and waterfowl).

Treatment

There is **no treatment for Newcastle disease**. Antibiotics may be given to help prevent or reduce the effects of secondary bacterial infections. Prevention is key because even vaccination is not always an effective deterrent. This emphasizes the importance of a strong biosecurity and flock protection program.

Public Health

Humans can contact Newcastle disease. The virus can survive in the eyes and nasal passages of individuals who have been in contact with infected poultry or other birds and these individuals can get conjunctivitis (swelling and reddening of the tissues around the eyes) or mild flu-like symptoms. **No human cases of Newcastle disease have occurred from eating poultry products.** Newcastle disease is not a food safety concern, and properly cooked poultry products are safe to eat.

Sources of Help

- Your local county Extension agent
- Your local veterinarian
- Tennessee State University Extension Poultry Specialist (615-963-5823)
- University of Tennessee Extension Poultry Specialist (931-486-2129)
- C. E. Kord Animal Health Diagnostic Laboratory (615-837-5125)

Reference

Onyema, I., D. C. Eze, Y. Abba, P. E. Emennaa, S. V. O. Shoyinka, E. C. Okwor, W. S. Ezema, J. I. Ihedioha, and J. O. A. Okoye. 2019. Lesions of velogenic viscerotropic Newcastle disease virus infection were more severe in broilers than pullets. *J. Appl. Anim. Res.* 47(1):189-194



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