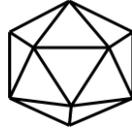


## Rotavirus Infection in Pheasants:



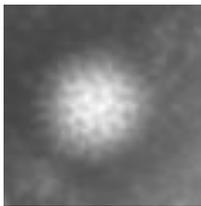
### What is it and what can we do about it?

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I diagnosed my first case of rotaviral enteritis in pheasants about twelve years ago. I have seen many other cases since that time and have received many questions from growers, farm managers and veterinarians about this disease. I'd like to share a few of these questions with you. Not all of the questions will have the best answer because there is much to learn. Perhaps this will give you a better understanding of this infection in birds.



**What is rotavirus?** Rotavirus is a small virus in the reovirus family that lives and multiplies in the intestine of mammals and birds. The virus can destroy small intestinal epithelial cells to cause diarrhea. The virus, as shown in this electron photomicrograph, has an icosahedral shape and does not have an envelope, the latter which makes it more resistant to a variety of detergents and disinfectants. The nucleocapsid (genetic core) contains eleven segments of double-stranded RNA. Each gene segment encodes a different viral protein to create the entire virus. The virus must invade intestinal epithelial cells to replicate.

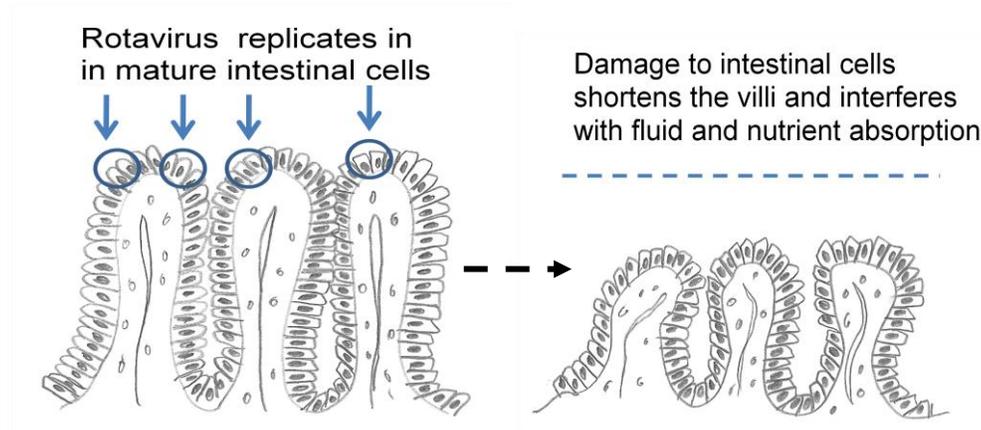
**Are all rotaviruses the same?** No, in fact, different rotaviruses have been identified in pigs, rabbits, turkeys, pigeons, chickens, cattle, guinea fowl, lovebirds, partridges and pheasants. It is easier to find the virus in young animals that have diarrhea. Rotavirus in humans is the leading cause of diarrhea and gastroenteritis in children 6-24 months of age worldwide (Schumann et al., 2009). There is no evidence that rotaviruses in birds can infect people, although on rare occasion some human rotaviruses can contain genomic segments of animal rotaviruses. Rotaviruses can be characterized into different groups by serum neutralization, enzyme linked immunosorbent assay (ELISA) and by migration patterns on polyacrylamide gel electrophoresis (Legrottaglie et al., 1997). Type A, D, F and G rotaviruses have been detected in birds. Although most human rotaviruses are type A and pheasant rotavirus is antigenically related to type A rotavirus there is no evidence that avian rotaviruses can be transmitted to people; these viruses are antigenically

and genetically dissimilar (Schumann et al., 2009). Avian rotaviruses have not been detected in humans and human rotaviruses have not been detected in birds. It appears that by genetic analysis pheasant rotaviruses are only distantly related to other rotaviruses, including those of other poultry (Ursu et al., 2009).

**How long have pheasant rotaviruses been around and how were they discovered?** Much of the research with rotavirus in gamebirds has been driven by initial studies with turkeys and chickens. Intestinal rotaviruses in birds have probably been around a very long time, but rotaviruses were not identified in poultry (turkey poults) until 1977 (Bergeland et al., 1977). In Ireland, McNulty et al. (1979) isolated rotavirus from 6-day-old turkeys and chickens with diarrhea. In 1985, rotaviruses in U.S. poultry were first identified in feces of chickens, turkeys and pheasants with diarrhea (Yason and Schat, 1985, Reynolds et al., 1986). The feces were concentrated and evaluated by electron microscopy to identify the virus. Using electron microscopy Gough also identified rotavirus in the feces of diarrheic pheasant chicks in England (Gough et al., 1986).

**Are rotaviruses the only intestinal viral infections in poultry?** No, but rotaviruses are the viruses identified most often in gamebirds with diarrhea. Other viruses, such as astrovirus, reovirus, enterovirus, coronavirus and adenovirus have been detected in the manure of turkeys and chickens with diarrhea (Saif et al., 1985, Reynolds et al., 1987). Gough et al. (1990) in England identified rotavirus, reovirus, enterovirus and adenovirus in the intestines of sick pheasants and partridges. In my experience most causes of viral enteritis that I have seen in gamebirds has been associated with rotavirus, while I have diagnosed many different causes of viral enteritis in turkey poults.

**How does rotavirus cause diarrhea?** Large numbers of rotaviruses are shed in the feces of infected birds. The virus is then contracted by swallowing contaminated manure which may be on the soil, feeder, drinker or equipment, shoes and clothing of flock managers. There is no evidence that rotavirus can be transmitted inside eggs. The virus must multiply in mature enterocytes at the tips (apices) of intestinal villi rather than the deeper crypts (Hayes et al., 1994). Damage to enterocytes with blunting of the villi results in decreased nutrient and fluid absorption as well as secretion of increased fluid into the lumen of the intestine.



**What are the clinical signs and gross lesions of rotavirus infection?**

Clinical signs of rotavirus infection in pheasants and partridges usually start as early as 4-14 days of age, but signs can be observed in birds as old as 6 weeks.

Clinical signs- Can include any of the following

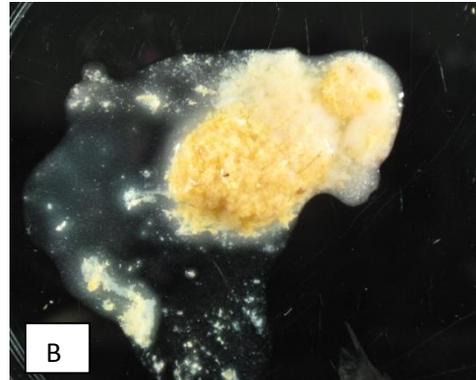
- Depression
- Lack of movement
- Discomfort- chirping and litter eating
- Diarrhea or wet manure/litter
- Huddling
- Droopy wings and closed “sleepy” eyes
- Decreased feed consumption
- Piling in corners
- Vent pecking

Birds become depressed, stop eating and huddle. Sudden death can occur early without other clinical signs. There can be history of piling in corners in some cases. Mortality can occur earlier and with greater severity if Salmonella infection is present along with rotavirus. Long term effects of survivors can be stunting and lack of uniformity in flock. Severely affected birds will never reach full size (stunting).



A. Huddling is a common sign of gamebirds with rotavirus infection, and diarrhea may not always be observed.

B. Turkey poult: a common lesion of rotavirus infection is small intestine and ceca distended with clear fluid and gas. Similar lesions are observed in gamebird chicks.



A. Pheasant chick: gizzard is distended with litter. Affected chicks can appear as “starve-outs.”  
 B. Intestines affected by rotavirus can contain fluid and gas as well as undigested feed as shown here.

**Where does the rotavirus come from?** This is the million dollar question when an outbreak occurs. Infected birds shed millions of rotaviruses in their feces. The virus is quite hardy; few studies have been done on avian rotavirus, but human rotavirus can survive on skin for four hours, survive on dry surfaces for ten days and survive on a wet surface for many weeks. In addition, the virus can survive longer when protected in fecal material. Virus can be carried on the surface of darkling beetles or skin of rodents. There is no evidence that birds have a permanent carrier state, nor is there evidence that virus is carried inside breeder eggs. In theory, the surface of breeder eggshells could be contaminated with feces or soil containing virus, but routine cleaning and disinfection of eggs should eliminate the virus. Emphasis should be placed on cleaning and disinfection of the brooder pen between growouts. Residual virus, which is quite hardy, can continue to infect successive growouts if not eliminated from concrete floors, soil, wood walls or slats, feeders and drinkers. Brooder managers should avoid contact with older birds or equipment from breeder pens when growing chicks.

**How can I tell if my flock is infected with rotavirus?** Laboratory tests and necropsies of birds are needed to diagnose rotavirus infection. Don’t assume that death and diarrhea in pheasants and partridges is caused by rotavirus because there are lookalike diseases.

**What other diseases can resemble rotavirus infection?** A full diagnostic work-up, including necropsy of affected birds, can rule out other diseases that cause sudden death, huddling and starveout in chicks. These diseases can be caused by infectious agents such as Salmonella, Escherichia coli, Clostridium and coccidiosis. Keep in mind that gamebirds can often be infected with two or more infectious agents at the same time.

**How can rotavirus infection be treated?** Rotavirus cannot be killed by antibiotics, but antibiotics can help to prevent secondary bacterial infection. Farms with a history of rotaviral enteritis in successive growouts might consider the use of probiotics in healthy chicks. There are a number of probiotics on the market and no guarantee that they will work. Increase the temperature under the brooder for chilled birds and walk the pen several times a day to stimulate

the birds to move, eat and drink. An inactive gamebird chick will quickly become a dead gamebird chick. Avoid contact with other gamebirds and do not visit other farms or pens if you are working with sick chicks. Chicks raised on wire flooring at early ages will have fewer outbreaks of rotavirus, Salmonella and coccidiosis.

**How can we eliminate the virus?** Because rotavirus has no lipid envelope it is not readily killed by detergents and can be resistant to some disinfectants. Several generic disinfectants that should be effective against rotavirus include oxine, glutaraldehyde, hydrogen peroxide, sodium hypochlorite (bleach), Virkon-S, phenol (One-Stroke Environ), Chlorhexidine (Novalsan). Iodophores and quaternary ammonium compounds might be less effective (Heit et al., 1995). In the face of a rotavirus outbreak and between flocks it is essential to remove all litter, thoroughly dry clean, wet clean with detergent, and then apply disinfectant. Sunshine and down time in the brooder pen are also effective in reducing the load of bacteria and viruses. More aggressive disinfection might be needed if the brooder pen contains irregular or creviced surfaces such as wood, soil and concrete. There is no substitute for enhanced biosecurity with chicks to reduce the opportunity for introduction of infectious agents into the flock. In summary, it may be impossible to completely eliminate the rotavirus from a premise once it has been introduced, but one can reduce the viral load to which new chicks will be exposed.

**Finally, is there a vaccine for rotavirus?** No commercial vaccines are available for poultry. Because of the worldwide concern about rotaviral gastroenteritis and diarrhea in human infants there have been oral vaccines developed for use in high-risk areas. Vaccine research in enteric viruses of turkeys has met with only limited success. Because of the antigenic differences between turkey and pheasant rotaviruses it is unlikely that a commercial turkey rotavirus vaccine, if it existed, would be effective in gamebirds.

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