

Egg binding and soft egg shells in hens and renal disease in males (calcium and Vitamin D3 related)

Dr. Bruce Hunter,¹ Ashley Whiteman,¹ Dr. Babak Sanei,² and Al Dam²

Species

Egg binding (hens have difficulty passing an egg) and soft shelled eggs are common problems in hens of all domestic and captive bird species. Osteoporosis (fragile, brittle bones) is an important welfare concern for older layers. These conditions are common in high-producing birds fed "home-formulated" diets and osteoporosis also occurs frequently in well-fed commercial egg-laying chickens.

Status in Canada

This is a very common condition in laying hens

Etiology

The modern strains of laying hen are able to produce well over 200 eggs in a laying period. Older, more traditional dual-purpose strains of chicken produce fewer eggs a year. Every egg produced has an egg shell made mainly of calcium carbonate. Every egg shell formed requires approximately 1.7 grams of calcium, creating an enormous calcium demand for a high producing laying hen. This amount of calcium (i.e. 1.7 grams) is actually greater than what a hen can absorb from the diet each day. Therefore, in order to shell an egg properly, the bird must utilize the calcium that has been stored in her skeleton.

Adequate calcium must be present in the diet prior the hen beginning egg production or over time she will deplete the calcium in her skeleton and develop brittle bones or osteoporosis (similar to the condition that occurs in women). Calcium should comprise 3-3.5% of the laying hen ration. Whole grains contain far less than 1% calcium and so whole grain and scratch grain diets are not adequate for egg producing hens.



Calcium and Vitamin D3



The Disease

A deficiency of calcium and vitamin D3 in the diet of laying hens will result in poor egg shell quality and reduced egg production. Egg shells will become soft, improperly formed and may have shell deformities. Over time, egg production will decrease and hens may develop osteoporosis (brittle bones that break easily). These hens will be found "off their legs" and unable to stand and may appear to be paralyzed. Occasionally hens may become "egg bound" and unable to pass eggs. This condition is due to depletion of calcium in the blood stream and insufficient calcium being available for proper muscle contraction of the uterus during the egg laying process.

Many back yard and hobby farmers keep a few hens for supplying eggs and also grow out some meat type birds and perhaps keep a few roosters. It is important to note that roosters and young growing birds cannot handle high calcium diets and will develop severe kidney disease if high levels of calcium diets are fed. So if you have both egg laying hens as well as roosters and young growing stock on your farm, they must be fed separate diets.

Calcium regulation and calcium demand is different in male birds and young growing birds compared to producing laying hens. The excess calcium taken in the diet must be eliminated either by decreased gut absorption or by excretion via the kidneys. The high mineral content damages the kidney tubules and results in abnormal deposition of calcium in muscle, heart, blood vessel walls and other organs that quickly kill the birds.

Treatment

Calcium deficiency is difficult to reverse once the hen has reached the point where the skeletal calcium stores are depleted. Calcium and vitamin D3 supplementation combined with feeding a proper diet is the only treatment. The only way to prevent this condition is to provide a proper diet with high levels of calcium prior to the start of egg production to ensure that adequate calcium has been stored the skeleton. This is followed by providing a properly balanced diet during the egg production cycle.



Remember, roosters and growing birds should not be fed layer diets. There is no treatment for hypercalcemia and renal failure other than changing the diet and supplying adequate drinking water to help flush the kidneys.

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Coccidiosis

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Species

Most species of birds can be infected with one or more species of the protozoan parasite coccidia. Birds showing clinical signs of infection have coccidiosis. Most species of coccidia are specific to a particular group of birds and don't cross infect other species, i.e. chicken coccidia don't infect ducks etc. Generally coccidiosis is a disease of the digestive system. It is perhaps the most economically important disease of commercial poultry on a global basis.

Status in Canada

Coccidiosis is common in all birds species but particularly important in chickens and turkeys.

Etiology

Coccidiosis is caused by a small, microscopic protozoan parasite. The most important disease-causing species of coccidia belong to the Genus *Eimeria*.

There are 5 species of *Eimeria* that affect chickens in Canada

E. acervulina,
E. necatrix,
E. maxima,
E. brunettii
and *E. tenella*

and several that affect turkeys

E. gallipovonis,
E. meleagridis,
E. adenoeides,
E. meleagrimitis

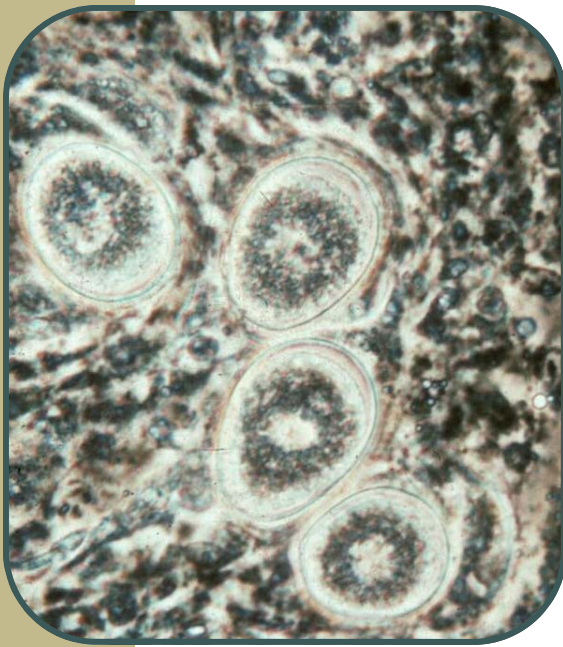
and others.



The Disease

Coccidia have a 2 stage life cycle. The asexual stages cause most of the lesions. Oocysts are passed in the feces. These sporulate (i.e. undergo cell division) in the environment and become infective. It takes approximately 5 days under suitable environmental conditions for the coccidia eggs to become infective. The bird ingests these sporulated oocysts by picking them up from the ground. Inside the intestine the acid and enzymes present break down the protective oocyst wall and tiny sporozoites are released in the gut. These infect the enterocytes (cells lining the intestinal tract) and within these cells they undergo several stages of asexual replication, a process called schizogeny or merogeny. The developing schizonts damage the enterocytes causing diarrhea and depending on the species, severe gut damage. After several cycles of asexual reproduction the coccidia undergo a stage of sexual reproduction that results in the formation of more unsporulated oocysts that are passed in feces.

Different species of coccidia affect different portions of the gut. For example *E. acervulina* affected the upper small intestine and produces mild lesions. *E. necatrix* and *E. maxima* affect mainly mid gut and lesions can be very severe. *E. tenella* affects mainly cecae and colon and can also be severe.



coccidia eggs (oocysts): Unsporulated (above) and sporulated (right) . Note the oocyst on the right now contains 4 sporocysts each containing infective sporozoites. This is the infective form.

Coccidiosis worldwide is likely the most important disease of floor-raised chickens. Even mild damage to the intestinal tract will cause growth slowdown, diarrhea, wet litter, and uneven flocks so even mild infections cause economic loss in commercial operations. Some species of coccidia will cause significant losses from death. Coccidia causes enough damage to the gut lining that secondary infections with the bacterium *Clostridium perfringens* (a disease known as necrotic enteritis .. see necrotic enteritis fact sheet) commonly occur.



Diagnosis

A diagnosis of coccidiosis is made by gross examination of the intestines and the demonstration of coccidial eggs under the microscope in intestinal scrapings or examination of feces from the bird. The species of coccidia can be identified by measurement of the coccidial oocysts. Often the damage caused by the coccidia may appear mild, but the economic losses may be significant from decreased growth rates and poor feed conversion.



Chicken intestine infected with E. tenella. This species causes severe damage and hemorrhage in the cecum of chickens that may result in high mortality.



Chicken intestine infected with E. necatrix. Note the dark portion of the mid portion of the intestine. This portion of the intestine has been severely damaged by the coccidia and contains blood. E. necatrix can cause high death losses.





Treatment

There are numerous drugs that are used to treat coccidiosis. Most commercial poultry producers in North America use routine anticoccidial medications in the feed of growing birds to prevent the disease and many others vaccinate against the parasite. Feed with anticoccidial drugs are available from most feed mills but many smaller backyard or hobby flocks do not buy their feed in sufficient quantities to have a coccidiostat added. Many of the commercial starter rations available for chickens have a coccidiostat added. Make certain to check the label and consult with the feed supplier.

Treatment of an outbreak of coccidiosis is usually done using anticoccidial medication like amprolium added to the drinking water. Consult your veterinarian to confirm the diagnosis and recommend appropriate treatment.

Good litter management, thorough clean-up of manure and good pen sanitation will help reduce the incidence and severity of coccidiosis.



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E. Coli (Colibacillosis)

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The bacterium *Eschericia coli* (*E. coli*) is one of the most important causes of disease in confined or aviary birds regardless of the species. In commercial poultry *E. coli* is by far the most common bacteria associated with disease. All ages of bird are susceptible but the disease is particularly important in young birds either immediately post hatching or within the first few weeks of life. Disease may be much more severe if birds are housed in unsanitary conditions or in areas with high ammonia levels or poor ventilation.

Etiology

There are hundreds of different varieties (serotypes) of avian *E. coli*. Most of these do not cause disease and are part of the normal flora of the intestinal tract of the bird. The disease Colibacillosis is caused by certain strains of *E. coli*. Serogroups 01, 02, and 078 are the most common pathogenic (disease causing) serogroups in poultry. Other *E. coli* serogroups may be associated with respiratory tract infections, generalized infections affecting many body systems and diarrhea in pet birds, ratites, waterfowl and pigeons.

The Disease

E. coli infections can cause several different disease conditions.

Colibacillosis - is the term used for the sudden onset (acute), generalized infection (septicemia) with *E. coli* infection in young growing broiler chickens or turkey poults.

Young birds may be infected in the hatchery and these birds develop naval infections and omphalitis.

Young birds can also be infected when they arrive at the farm if they are placed in areas contaminated with the bacteria. Pathogenic *E. coli* is able to survive in barns between crops or it may be tracked into the barn through breaches in biosecurity.



Cellulitis - is the term used for *E. coli* infections of the skin and subcutaneous tissues (areas under the skin). Cellulitis is the number one cause of condemnation in commercial broiler chickens going through processing. Affected birds develop inflammation and accumulation of exudates under the skin of the belly and between their legs. These infections are caused by bacterial contamination of scratches on the backs of the birds as they crowd around feeders and water drinkers.



Modern broiler chickens may grow so fast that as they near market weight they still are not fully feathered. If these birds are crowded and have to compete with each other for feeder and drinker space they often scramble over each other trying to access the feeders resulting in scratches to the skin. Cellulitis can also occur over the head region likely an extension of an *E. coli* infection of the sinuses and upper respiratory tract.

Broiler chicken with cellulitis of the head. Note the puffy, swollen head. If the skin were to be removed there would be a cottage cheese-like exudates under the skin.

E. coli may also cause airsacculitis, peritonitis, sinusitis, diarrhea and septicemic disease in pet birds.

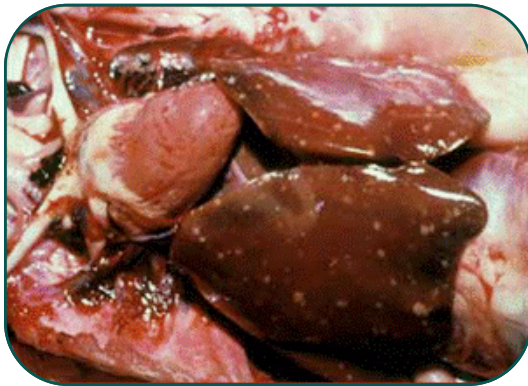
Septicemia - is the term used to describe generalized bacterial infections affecting many organs in the body. *E. coli* bacteria is a common cause of septicemia in birds. The initial infection may start as a diarrhea or perhaps as a respiratory infection and as the bacteria causes damage to that organ it enters the blood stream and is disseminated throughout the body, often affecting many organs.

Husbandry practices, particularly poor air quality (eg. high dust levels or ammonia levels), poor sanitation or high levels of stress are common factors that predispose to *E. coli* infections.

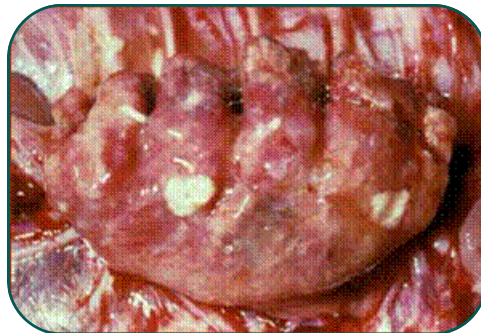




Above photo: Young broiler chickens gasping and mouth breathing due to airsacculitis and E. coli respiratory infection.



Liver with multi-focal depressed, white spots consistent with liver damage caused by septicemic *E. coli* infection.



Above photo: Chicken lung that is red and firm and covered with exudate. The pneumonia in this bird is caused by *E. coli* infection.



Broiler chicken with *E. coli* airsacculitis.



Heads of two broiler chickens with skin removed to demonstrate the yellow exudate under the skin (cellulitis) caused by *E. coli* infection.



Treatment

Treatment is by using the appropriate antibiotics as directed by your veterinarian. Good husbandry and a high level of barn sanitation will reduce the amount of bacteria and reduce the risk.

Prevention

There are no vaccines that successfully prevent *E. coli* infections in birds.

If you raise your own breeder birds and incubate your own eggs then proper egg collection and handling is critical to ensure that cracked eggs and those surface contaminated with feces are not placed in the incubator. Careful incubator/hatcher cleanliness and sanitation will help prevent early infections in hatching chicks.

Biosecurity, good barn management (ventilation and litter quality) and a good cleaning and sanitation program will decrease the risk of *E. coli* infections by reducing the amount of bacteria present. Slowing the growth rates of birds and making sure they are not over-crowded (i.e. there is suitable floor space and adequate numbers of feeders and drinkers for each bird) will greatly decrease the risk of cellulitis.



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Histomoniasis - Black-head

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Species

Black-head can infect all gallinaceous birds but turkeys, pheasants and pea fowl are particularly susceptible. Occasionally it is seen in chickens.

Status in Canada

Histomoniasis (commonly called "black-head" in the poultry industry) is a common disease in backyard flocks and aviary birds but is uncommon in commercial flocks because of husbandry practices.

Etiology

Histomoniasis is caused by the protozoan parasite *Histomonas meleagridis*. This is a common parasite that has a complex life cycle. The disease generally follows a history of turkeys (or other susceptible species) being raised in areas where chickens were or are housed. The life cycle of the protozoa utilizes *Heterakis* sp., the cecal worm of chickens as the intermediate host.

The parasite eggs are ingested by the final host (eg. turkey or pheasant) and they develop in the cecum (portion of the lower digestive tract ... see digestive system fact sheet). The developing parasite causes damage to the wall of the cecum. Some of the developing parasites penetrate into blood vessels and are carried to the liver via the blood stream. In the liver they cause severe damage.

The Disease

Clinical signs of the disease include white to orange diarrhea, a result of the damage to the intestinal tract. Once the liver is involved the feces often become yellow and the birds become depressed, appetite decreases and they lose body condition and eventually die.



Histomoniasis



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At necropsy there are lesions in the cecae with thickening of the cecal walls, inflammation and the development of cecal cores (see figure 1). There are typically multi-focal areas of necrosis and large distinctive “target-shaped” lesions in the liver. This combination of lesions is very suggestive of blackhead. The term “black-head” comes from the cyanotic discoloration of the birds head due to poor circulation in the sick bird.



Portion of lower digestive tract (cecum) and the liver of a bird dead of histomoniasis. Note the white, hard cores of dead material in the lumen of the cecum.



Liver of a pheasant with typical target shaped areas of damage caused by Histomonas

Treatment

Treatment of this disease is very difficult as virtually every effective drug has been removed from the Canadian market. There are still a couple of drugs available as feed additives for preventing histomoniasis that are used in the turkey industry.

Treating sick birds is usually unrewarding because lesions are extensive before birds show any clinical signs. Usually the diagnosis is made at necropsy and a decision made whether to treat the rest of the flock. There is no human health risk associated with this disease.

Prevention

Black-head is preventable by good management and good biosecurity (see the principles of biosecurity fact sheets). Do not raise pheasants, turkeys, peacocks or other game birds with chickens. Do not raise turkeys or other susceptible species on ground that once housed chickens. If this is not possible, confining birds in well cleaned pens and supplying feed medicated with a histomonistat will help prevent the disease.



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Infectious Bronchitis (IB)

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Species

Infectious bronchitis (IB) is an infectious viral disease of chickens.

Status in Canada

IB is common and economically important in commercial broiler and laying chicken industries in Canada and globally.

Etiology

IB is caused by a corona virus specific to chickens. There are numerous serotypes of this virus and because it has the ability to mutate and change there are often new variant strains developing.

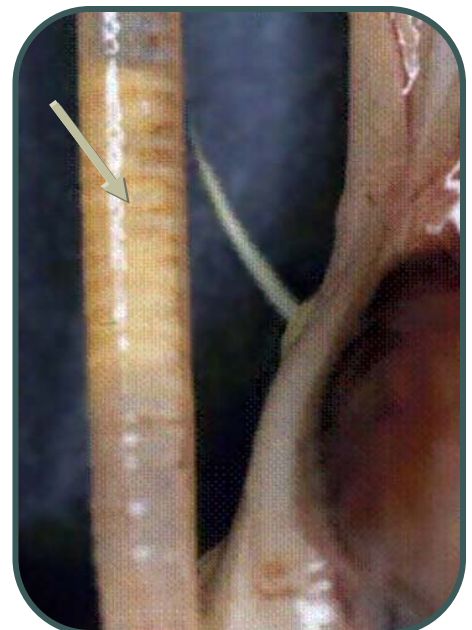
The Disease

This group of corona viruses infect birds through the respiratory system. Once infection in the lungs has been established the virus can be carried to other organs of the body via the blood stream. Most notably the reproductive tract of laying hens and the kidneys of young birds are infected.

Depending on the strain of corona virus and the age of the bird, infection can present in different ways.

In young birds the disease is mainly a respiratory infection with inflammation of the upper respiratory tract particularly the trachea (wind pipe) and bronchi. Affected chicks are chilled, huddle together and sneezing and coughing is common. Affected birds have reduced growth performance. Many birds in the flock will become ill and mortality rates may be

Windpipe (left) from a broiler chick infected with IB virus. The white material (arrow) is a plug of inflammatory and dead cellular debris that has plugged the windpipe and the birds has asphyxiated.



Infectious Bronchitis



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high. Sometimes cellular and inflammatory debris from the infection will plug the airways and cause gasping or asphyxiation.

Some strains of the virus grow particularly well in the kidneys (termed nephrotropic). These strains cause kidney swelling and nephritis.

In older birds, IB infections generally cause only mild respiratory infections but the virus travels to the reproductive tract and causes significant decreases in egg production. The virus localizes in the oviduct causing abnormal formation of albumen (egg white) and poor quality eggs that often have abnormal shells. Damage to the oviduct may result in internal laying (eggs in the coelomic cavity of the hen).



Mature laying hen infected with IB. At necropsy the abdomen contained a number of fully formed but improperly shelled eggs (a condition termed internal layer)



Eggs from hen with IB infection showing abnormal shell formation and soft egg shells

Treatment

There is no treatment for affected birds other than supportive care (i.e. good management and nutrition). In young birds with respiratory disease secondary bacterial infections (often *E. coli*) may develop and antibiotics may be helpful.

Prevention

Almost all commercial flocks routine vaccinate breeder flocks and young birds against this disease. Back yard, specialty and hobby birds are rarely vaccinated. Consult with your veterinarian.



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Infectious Laryngotracheitis (ILT)

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Species

Infectious laryngotracheitis (ILT) is a viral disease of chickens, pheasants, quail and other game birds. There is also a strain of psittacine herpes virus (a separate virus) that causes a similar disease in Amazon parrots.

Status in Canada

ILT is not a common disease in Canada but several outbreaks occur every year. It has significant economic importance particularly in regions of the country where there are numerous commercial poultry farms. The disease is more common in small, backyard flocks where birds are taken to and from bird shows and sales barns.

Etiology

ILT is caused by a Herpes virus of chickens.

The Disease

The ILT virus loves the cells lining the upper respiratory tract. It infects these epithelial cells causing severe damage and necrosis. The damaged cells detach and this combined with the severe inflammatory reaction results in mucus and cell debris plugging the windpipe.

The lining of the windpipe may become red, raw and bleeding.

Affected birds are often severely depressed and may sneeze, shake their head in an attempt to clear the debris plugging the windpipe and cough up blood or bloody froth.

*chicken with ILT coughing blood .
The birds eyes are closed and it is
severely depressed.
(photo from ILT vaccine brochure)*



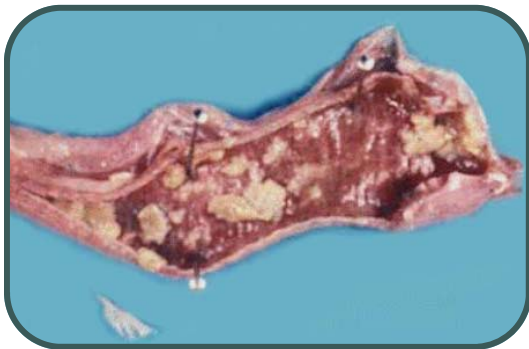
Infectious Laryngotracheitis



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Oral and nasal discharges and conjunctivitis are often present. With some strains of the virus and non-vaccinated birds the mortality rate may be very high. All discharges contain infective virus that can infect other birds.

At necropsy birds may have a discharge and reddening of the conjunctiva (area around the eyes) and the windpipe is red, sometimes containing blood, froth and exudate.



This trachea (wind pipe) from a bird with ILT has been opened to show the red lining and the white plugs of exudate in the tracheal lumen. These plugs are made up of inflammatory debris mixed with sloughed, dead airway lining cells.

A diagnosis can only be confirmed by identifying the herpes virus in infected tissues from the sick bird. Some laboratories grow the virus, others use a combination of molecular techniques or observe characteristic microscopic changes including typical intranuclear inclusion bodies (virus particles) in the affected cells lining the respiratory tract.

Treatment

There is no treatment for this disease. A decision needs to be made whether or not to cull the birds. Recovered birds will be immune to further infection but will carry the virus for a long period and will be a potential source of infection for other flocks or new unvaccinated birds brought into the flock. Sometimes treating with antibiotics will help prevent secondary bacteria diseases from occurring. Consult with your veterinarian.

Prevention

In the commercial poultry industry vaccination of breeder flocks and egg laying flocks is routinely done (eye drop technique). However, small farm flocks and show birds are rarely vaccinated because the vaccine comes in large multi-dose vials making it impractical and costly to vaccinate small numbers of birds. However, good biosecurity and careful purchase of birds (from honest sellers who provide a solid history) combined with isolation and quarantine of all new birds or those that have been taken off the farm (clubs, shows etc.) for 14-21 days will help reduce the risk of introducing this disease.



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Marek's Disease

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Species

Marek's disease is an important viral disease of chickens that causes paralysis and the formation of tumors that can occur in most organs of the body. Chickens are the main species affected. There are a few reports of Marek's disease occurring in other gallinaceous birds like pheasants and quail. Turkeys do not get Marek's disease.

Status in Canada

Marek's is a very common disease world wide including Canada. It is so common that virtually every commercial chicken is vaccinated against this disease in the hatchery (either at day of age or *in ovo at day 18 of incubation*). Clinical Marek's disease is very common in backyard, specialty and hobby flocks where vaccination is not usually done.

Etiology

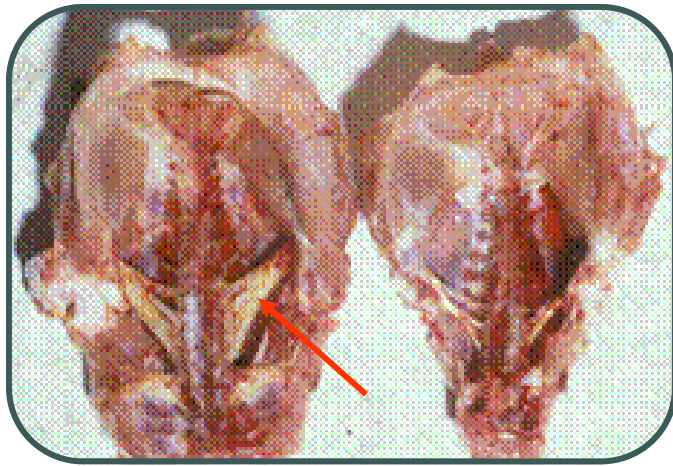
Marek's disease is caused by a Herpesvirus. There are 3 serotypes. Serotype 1 is the pathogenic type that causes disease and within this serotype there are several strains classified as mild, virulent and very virulent strains .. based on their ability to cause disease. Serotype 2 is a naturally occurring but causes no disease and serotype 3 is found in turkeys but causes no disease. Both serotype 2 and 3 have been used in vaccine production.

*If the nervous system is affected
The birds present with lameness
like the bird on the right or CNS
signs including incoordination or
paralysis.*



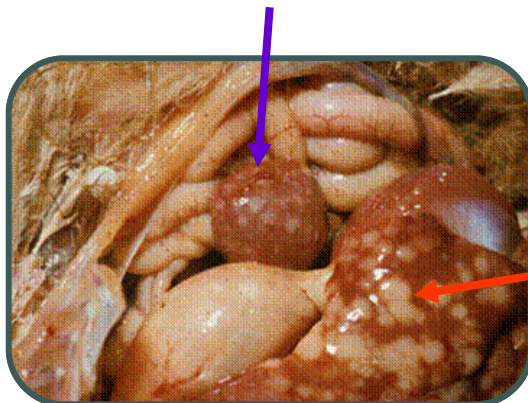
The Disease

Marek's disease virus causes two types of disease. Early in the infection the virus can cause severe inflammation in brain and nerves and damage organs of the immune system. Birds can die with inflammation in the brain (encephalitis or meningitis) or become immune suppressed. If the birds live long enough the virus may infect specific cells of the immune system (T lymphocytes) causing these cells to transform and develop into lymphoid tumors that commonly invade the nervous system and other organs.



This a photo of the body cavity from two birds. The .kidneys and other internal organs have been removed so that the nerves leaving the spinal column and going to the legs can be visualized. The bird on the left has swollen, yellowish and thickened nerves (see red arrow) due to Marek's tumor invasion. The bird on the right is not affected.

These tumors can develop in any visceral organ including liver, spleen, kidney, testicle or ovaries. Sometimes tumors occur in the iris of the eye, in follicles of the skin, in muscle and many other organs.



Internal organs of a chicken with Marek's disease. Note the white, raised tumors in the liver (red arrow) and spleen (blue arrow). The liver,

During the course of infection in a chicken, the Marek's virus finds its way to the skin and replicates in the feather follicle epithelium (cells forming the feather follicle). The virus is shed through feather dander and dust.



PHOTO (left) :Chicken will many raised bumps on the skin. This is Marek's disease tumors affecting the feather follicles



Left: photo of a chicken with Marek's disease tumor that has developed in the eye ball (actually the iris of the eye). The large white mass occupying almost the entire eyeball is the tumor. The eye on the right is not affected.



Treatment

There is no treatment for Marek's disease. Affected birds should be humanely killed and removed from the flock. Although there is no direct link between Marek's disease and human illness, birds with Marek's disease should not be eaten. Birds with tumors are always condemned at processing.

Prevention

Marek's disease is readily transmitted from bird to bird through feather dust and dander. The virus replicates in feather follicle epithelium and the bird likely sheds virus for life.

Prevention is through vaccination at day 18 of embryonation (*in ovo*) or on the day of hatch. The specific type (strain) of vaccine used is dependent on the strains of Marek's virus found in that area. Virtually every commercial chicken in North America and many parts of the world are routinely vaccinated.

Good barn management and thorough barn clean outs help to reduce the amount of virus in the environmental and will reduce the challenge to newly placed chicks.



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Newcastle Disease

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Species

Newcastle disease (ND) is a federally reportable Foreign Animal Disease and an outbreak can have huge economically impacts for both commercial poultry and non-regulated feather industries. All avian species can be affected. Strains of ND virus circulate in feral pigeons and in certain species of wild birds such as cormorants in North America.

Status in Canada

The highly pathogenic (velogenic) form of the disease is uncommon. Less pathogenic forms (mesogenic and lentogenic) are relatively common in backyard poultry and pigeons (both domestic and feral). Many commercial chickens are vaccinated with live lentogenic strains of vaccines, so these mild forms of virus are common and circulate in commercial poultry farms. The velogenic form of ND is federally reportable in Canada and in all member countries of the OIE (organization that regulates international world trade in animals and animals products). Any confirmed diagnosis of the velogenic form of ND would seriously affect the export of all poultry or bird products... the main reason why this disease is of so much concern.

Etiology

Newcastle disease is caused by a virus classified as a paramyxovirus (PMV-1). A process called pathotyping is done on every NDV isolate to determine how virulent it is for chickens. There are several pathogenicity indexes used including mean embryo death times (time it takes for the virus to kill chicken embryos in the lab) or the chick intracerebral pathogenicity index (length of time it takes for the virus to kill chicks inoculated in the brain with the virus). Three pathotypes are recognized: the lentogenic (mild) strains are fairly common and commercial vaccines are prepared from these viruses; mesogenic (moderate pathogenicity) isolates are not reportable but cause concern and higher mortality; velogenic (highly virulent) strains cause serious mortality and this form is federally reportable.

The Disease

The mild lentogenic strains of NDV may cause mild respiratory tract lesions with birds developing swollen sinusitis and tracheitis (inflammation of the windpipe) but generally infection with mild strains of virus cause no clinical disease. Mesogenic forms may cause inflammation of the windpipe (tracheitis), air sac infections (airsacculitis) and pneumonia and sometimes cause mortality. In laying hens egg production will drop. In pigeons, mesogenic strains of the virus can cause neurological signs including incoordination, twisting of the head, tremors and convulsions and death. This is an important disease of pigeons that can affect both their ability to race well and decrease productivity in squab and breeding operations.

The velogenic (very pathogenic) form affects all body organ systems. Lesions seen at necropsy include ulcerative lesions in the oral cavity and esophagus, hemorrhage and necrosis in the digestive tract particularly around the esophageal/proventricular junction and the cecal tonsils. There may be small hemorrhages on many organs and birds may have blue, discoloured combs, wattles and shanks of the legs caused by poor blood circulation. Affected birds often have pneumonia, sinusitis and conjunctivitis. Inflammation of the brain and spinal cord may result in a variety of neurological signs.



Chicken with velogenic ND showing severe nervous signs including the inability to stand and twisting of the head over its back. This bird has encephalitis.

Diagnosis

The diagnosis is based on the clinical signs, the suggestive lesions at necropsy and is confirmed by the recovery of the virus from affected tissues or by using specialized molecular tests. Every time a NCD virus is identified it is sent to the federal government (CFIA) laboratories for pathotyping. If the isolate is velogenic (highly infective), the Canadian Food Inspection Agency will immediately quarantine the facility and depopulate the flock. Compensation for the birds is paid to the farmer.

CFIA will oversee clean up and disinfection of the infected premise and indicate when it is safe to bring in new birds.

Pigeon Paramyxovirus type 1 (PPMV-1) is closely related to Newcastle Disease virus (NDV). In spite of their close relationship, there are clear antigenic (antibody stimulating) differences between NDV and PPMV-1, which can only be determined by laboratory testing.

PPMV-1 was isolated for the first time from pigeons in the Middle East in late 1970s and subsequently was introduced throughout North Africa. The virus was reported in Italy in 1981 and from 1981 to 1984, spread throughout the world. It was identified in Canada in the early 1980's. PPMV-1 has been isolated from pigeons, doves and ornamental birds in addition to commercial and feral pigeons. PPMV-1 infection in pigeons most commonly causes neurological signs including weakness, twisting of the head, head tremors etc. Sometime generalized signs and diarrhea (sometimes with hemorrhage) occur.

Pigeons can also be infected with exotic Newcastle disease virus, and when infected, they will show clinical signs, such as depression, diarrhea, and sudden death. Like infected chickens and turkeys, all ages are susceptible and can experience very high mortality (up to 90%). Pigeon lofts experiencing excessive mortality should immediately seek veterinary advice, submit birds to a local diagnostic laboratory, and stop all human and bird traffic in and out of suspect lofts.





Treatment and Prevention

There is no treatment for ND. If the mild strains of virus are involved good management and nutrition will help birds recover and antibiotics may help reduce the chance of secondary bacterial infections.

In the commercial chicken and turkey industries virtually all breeder birds and some growing flocks are vaccinated against ND. There is a vaccine available for use in domestic pigeons and it is recommended that all breeder birds and any birds entering races or attending bird shows be vaccinated.

Good biosecurity, adequate quarantine of birds returning from races or shows, prompt diagnosis and keeping breeding birds segregated from wild birds are important prevention methods,

Prevention

Prevention is possible through adherence to the principles of good on-farm and industry biosecurity, complimented by proper vaccination. Vaccines are available for commercial chickens, turkeys and pigeons. Poultry producers make the decision to vaccinate based on the value of their birds and risk levels. Virtually all commercial poultry breeder birds and egg laying birds are vaccinated against NDV several times during their life. Broiler chickens that are marketed at 39-43 days have a shorter risk period and some producers choose to not vaccinate. Pigeon breeders (both racing birds and those raised for squab) should all consider vaccination and racing pigeon clubs and bird shows should not allow birds to participate unless they have been properly vaccinated.

ND is endemic in populations of several species of wild or feral birds including gulls, cormorants and pigeons. These species pose a risk to your birds so sound biosecurity is very important.



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Raccoon Roundworm

Encephalitis Due to Raccoon Roundworms

Dr. Bruce Hunter,¹ Ashley Whiteman,¹ Dr. Babak Sanei,² and Al Dam²

Species

Infection with raccoon roundworms can occur in any bird species that has access to and ingests the feces of raccoons. This disease is most frequently seen in emu and ostrich but rhea are also susceptible. The disease can likely occur in all other bird species and it has been reported in pigeons, chickens and turkeys and pet psittacines (parrot family). Any age of bird can be affected but it occurs most commonly in juveniles.

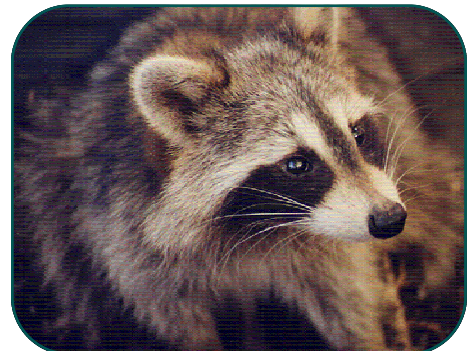
Status in Canada

The disease occurs fairly commonly in ratites bedded with straw and in regions of Canada (like Ontario) that have high populations of wild raccoons.

Etiology

Raccoons in southern Ontario and other parts of Canada are commonly infected with the intestinal roundworm (*Baylisascaris procyonis*). The parasite does not cause much problem for the raccoon except with very heavy infestations. Infected raccoons shed large numbers of eggs of this parasite in their feces, and these eggs are extremely hardy in the environment and will remain viable for years. The habit of raccoons living and defecating on hay and straw bales stored in barns results in contamination of this common source of livestock bedding.

The disease occurs when birds ingest dried raccoon feces or bedding material that has been contaminated with raccoon feces. Once the eggs are ingested the larvae emerge in the intestine and then migrate through the bird's body, sometimes ending up in the brain and causing clinical signs.





The Disease

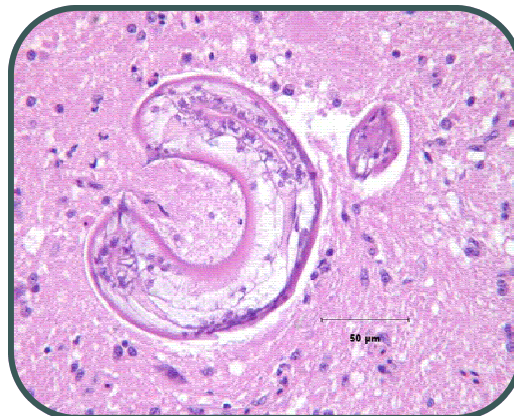
Birds characteristically show clinical signs related to damage to the portion of the brain called the cerebellum, which controls balance. They typically remain bright and interested in their environment and usually continue to eat, but may stagger, walk backwards, fall, and even be unable to stand and walk. Diagnosis can only be made after death where the brain is removed and examined by histopathology to identify the worms, or the characteristic lesions that they produce as they migrate through the brain tissue (see photo).

Prevention & Treatment

The only method of prevention is to use bedding and feed sources that are not contaminated with raccoon feces. Raccoons should not be allowed access to the barn or to feed or bedding storage areas. Raccoons also defecate in latrine sites which are often located in the crutches of large trees, or on the roofs of sheds or outbuildings. Feces from these sites may fall into bird pens or contaminate the ground. Contaminated sites can only be cleaned by thorough removal of all materials and by flaming or burning. There is no treatment for the disease once the worms reach the brain and clinical signs develop. Farms with continuing problems have incorporated antiparasitic drugs into their pelleted feed to kill the larvae on their path to the brain.

There is no health risk to people from infected birds. However people can be infected from handling raccoon feces or contaminated materials and then inadvertently putting fingers in their mouths and ingesting the eggs. Similar signs of brain damage and even blindness have been reported in people due to migrating raccoon worms. Proper sanitation and hand washing should always be done and particular care with young children who are usually less concerned about personal hygiene.

Microscope photo of a brain from a bird with a raccoon roundworm migrating through it. The worm on the right is cut in cross section.



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Rickets & Metabolic Bone Disease In Growing Poultry

Dr. Bruce Hunter,¹ Ashley Whiteman,¹ Dr. Babak Sanei,² and Al Dam²

Species

Rickets and nutritionally based bone problems occur very frequently in backyard and specialty types of birds. All birds, particularly fast growing birds fed "home-formulated" diets may be affected.

Status in Canada

Nutritional bone problems occur commonly any bird species fed diets other than those commercially formulated and targeted for that species and particular age of bird. The disease occurs relatively frequently in ostriches and emus due to their nutritional requirements and rapid early growth rates.

Etiology

Commercially formulated diets are scientifically balanced for protein, energy, vitamin and mineral content and other essential ingredients. These diets are formulated for particular species and specific ages of bird as the dietary requirements for the bird will change as it grows and develops. Home-formulated diets including the feeding of whole grains or scratch grain diets are generally poorly balanced, particularly in the amount of calcium and essential vitamins such as vitamin D3 or vitamin A. An imbalance in the calcium/phosphorus ratio in the diet will also result in abnormal bone development and high phosphorus levels in the diet even with normal calcium levels can result in bone disease.

Rickets and metabolic bone disease is caused by a deficiency of calcium or vitamin D3 in the diet, or an imbalance in the calcium to phosphorus ratio in the diet.

Group of young turkey poults with rickets. All of these birds are alive but refuse to stand and walk because of the painful changes in the bones.



Rickets & Metabolic Bone Disease



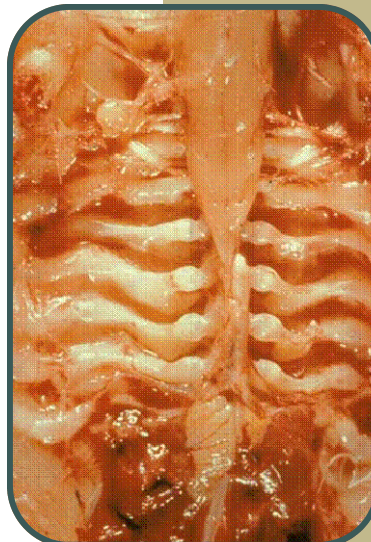
FACTSHEET 6.1
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The Disease

The skeleton of young animals grows extremely quickly. Species that grow very rapidly like commercial strains of chickens and turkeys and ostriches and emus are particularly susceptible. Calcium and phosphorus are essential minerals that are critical for proper bone growth and bone strength. The absorption of these minerals and the ability to incorporate them into the growing skeleton is dependent on the availability of Vitamin D3.

If either of these nutrients are lacking in the diet, the skeleton will not mineralize properly and the bone strength will be affected. As the bird gains in weight, the soft, poorly mineralized and rubbery bones bend and twist easily. These lesions are painful and the birds are lame and reluctant to walk. Because of the pain and physical deformities the birds have difficulty reaching the feed and water and will lose body condition and eventually die if not treated.

At post mortem the bones may be twisted and bent. Because they are poorly calcified the bones bend like rubber rather than snap and the growth zones at the end of each bone are wider than normal. There is often beading of the ribs at the junction of the spinal cord. The beak may bend easily. Folding fractures of the long bones and the ribs, and flattening of the rib cage, may also be seen. The parathyroid glands are usually enlarged.



Rib cage from a young duck with rickets. Note the banding and twisting of the ribs and swollen areas where the ribs join the back bone. This softening and swelling of the bone at this location has been referred to as the "ricketic rosary".

Treatment

Treatment involves correcting the diet as soon as possible before the bone deformities become too severe to be reversed. Placing birds on a commercial diet designed for that age and species of bird and supplementing the feed with calcium (for example top-dressing the feed with dicalcium/phosphate or oyster shell etc.) and adding vitamin D3 in the drinking water. Remember, birds can only utilize vitamin D3 not other forms of vitamin D packaged for mammals. It is generally safe to assume that if the birds are developing rickets on a home-formulated diet, then they likely have other vitamin/mineral dietary problems as well, and so supplementation with multi-vitamin mineral packs may be helpful.

Proper diets are critical to raising healthy birds. Resist the temptation to buy cheap scratch grains and whole corn. Your investment in properly formulated and well balanced diets will pay dividends in good growth and healthy birds.



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Vitamin A Deficiency

Dr. Bruce Hunter,¹ Ashley Whiteman,¹ Dr. Babak Sanei,² and Al Dam²

Species

Vitamin A is an essential vitamin for all species of birds. Disease occurs most commonly in hobby birds raised in cages (ie.e no access to natural foraging) and those fed home-made rations. Vitamin A deficiency would rarely occur in commercial birds or those fed formulated rations as Vitamin A is always a component of the vitamin/mineral premix.

Status in Canada

Not very common but seen usually in late winter and early spring after birds have been fed stored feed.

Etiology

The cause of this condition is dietary deficiency in vitamin A. Vitamin A has many biological functions. One of the most important is maintaining the health and integrity of cells lining the oral cavity and respiratory tract. If vitamin A is deficient in the ration, cells lining these the oral cavity and respiratory system fail to develop properly leading to plugging of glands and loss of cilia in the respiratory tract.

Vitamin A is essential in allowing cells to mature properly and glandular cells to function properly. Birds with a vitamin A deficiency develop raised white nodules throughout the oral cavity as esophageal glands become plugged with keratin and have a high incidence of pneumonia and respiratory infections due to a loss of the normal protective mechanisms in the respiratory tract.

Cause:

Diet lacking vitamin A.

Transmission:

- none

Symptoms:

- Nose discharge
- Respiratory problems
- Prone to infections

Vitamin A Deficiency



Diagnosis

Diagnosis is made based on the gross changes in oral cavity and conformed by microscopic examination of scrapings from oral lesions or biopsy of lesions.



African grey parrot with swelling under the lower bill (arrow). This is actually a swollen sublingual gland plugged with keratin .. Typical of vitamin A deficiency.

Treatment and Prevention

Treatment is through supplementation with vitamin A usually through adding multi-vitamins to the drinking water. In advanced cases the bird may have to be injected with vitamin A to get an appropriate response. The diet should be carefully reevaluated.

Vitamin A is not very stable and will break down under storage. The normal half-life of the vitamin is approximately 6 months so feed stored for prolonged periods (i.e. > 6 months) or kept in poor storage conditions (subjected to heat and moisture etc.) is often the reason the deficiency occurs and the reason that most cases Always feed fresh feed

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