

Update on Turkey Reoviral Arthritis/Tenosynovitis

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What is turkey arthritis reovirus? Turkey arthritis reoviruses (TARV) have been isolated from the gastrocnemius tendons and hock joints of lame male turkeys in the Midwest. Affected flocks often seroconvert for reovirus and show lameness after 12 weeks in age. From 2011-2015, the Minnesota Veterinary Diagnostic Laboratory received whole turkeys or turkey legs from flocks with history of lameness and swollen hock joint. All samples were largely negative for aerobic and anaerobic bacteria as well as for Mycoplasma. Reovirus was isolated from tendon tissues in approximately 40% of these cases; the presence of virus confirmed by EM, RT-PCR and gene sequencing. A preliminary report on virus isolation, RT-PCR and sequencing has been published (reference below). This report analyzed an 880 bp sequence of the S4 gene of a variety of avian reoviruses and indicated that TARV's bear close homology with turkey enteric reoviruses (TERV), but only partial identity with chicken arthritis reoviruses (CARV) as shown in Figure 1. Furthermore, we have compared several TARV isolates with TERV and CARV isolates in terms of pathogenicity for turkeys. We have reproduced Koch's postulate with TARV by inoculating one-week-old turkeys by the oral, intratracheal and footpad routes. By four weeks after infection the affected turkeys are not lame, but have histologic evidence of lymphocytic tenosynovitis. TARV was isolated from inflamed gastrocnemius tendons of lame, infected turkeys out to 12 weeks. Similar lesions are not produced in turkeys by TERV or CARV. In a subsequent study, turkeys orally inoculated with TARV began to show signs of lameness (altered gait scores) after 12 weeks of age.

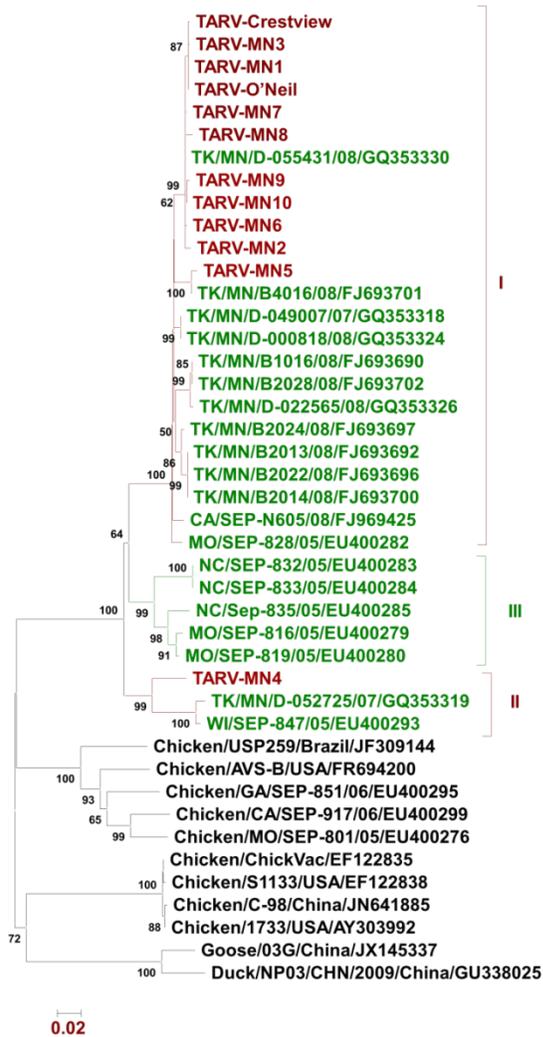


Figure 1. Phylogenetic diagram of S4 gene sequences for poultry reoviruses show relatively high degree (88 to 100%) homology between turkey arthritis reoviruses (brown) and turkey enteric reoviruses (green), whereas nucleotide identity of TARV with CARV (yellow) is 77.4% to 78.2%.

How is TARV infection diagnosed? Most cases are observed in tom turkeys after 12 weeks of age, but hens are occasionally affected. Lameness is associated with (intertarsal) joint swelling with subcutaneous edema in one or both legs (Figure 2). The gastrocnemius and digital flexor tendon sheaths can contain increased synovial fluid and fleck of white exudate. This condition can affect 5-40% of the flock. The condition when first described was associated with rupture of the gastrocnemius tendon; however, this occurs in a relatively small percentage of infected turkeys (Figure 3). Stretched or ruptured digital flexor tendons can be observed as well (Figure 4). The severe lameness results in culling of birds as the primary cause of death; however, flocks with TARV-induced lameness often have increased death loss from aortic rupture.



Figure 2. Sixteen-week-old tom turkey that is positive for reovirus: TARV-infected turkeys often have periarticular swelling of one or both hock joints.



Figure 3. Fifteen-week-old tom turkey that is positive for reovirus: The swollen hock joint on the left is dissected to reveal subcutaneous hemorrhage associated with rupture of the gastrocnemius tendon (arrow).

Thorough and complete diagnosis of TARV tenosynovitis should include longitudinal section of long bones and collection of samples to rule out the presence of bumblefoot (bacterial pododermatitis), tibial dyschondroplasia, bacterial osteomyelitis, Mycoplasma, femoral spiral fractures, skeletal muscle rupture, and tendon rupture from other causes. Virus isolation remains the gold standard for definitive diagnosis of turkey reoviral arthritis.

Does TARV cause aortic rupture in turkeys? We have not confirmed a cause and effect relationship. Our lab has analyzed hearts and aortas from flocks with turkey reoviral arthritis. I am unable to observe microscopic lesions in these organs, nor are we able to detect reovirus in these tissues by polymerase chain reaction or virus isolation. Additionally, we have induced lameness in tom turkeys by inoculating them with TARV. These turkeys become lame by 12 weeks of age, and some show ruptured gastrocnemius tendons, but none of the birds developed aortic rupture.

How is TARV transmitted? Our studies have demonstrated that inoculated poult chicks can transmit the infection laterally, likely through manure, to pen mates. Our industry partners have shown that, in some instances, intramuscular vaccination with autogenous, killed TARV has been able to reduce onset of lameness in offspring, but vaccination by this method has not been 100% effective. Vaccination failure might be a result of antigenic changes in the virus as it passes through a flock. Egg transmission of chicken arthritis reovirus (CARV) has been well documented and has been effectively controlled by vaccination of broiler breeder flocks.

Has the presentation of TARV remained the same? As mentioned before, I see fewer gastrocnemius tendon ruptures submitted to the diagnostic laboratory. Most legs have periarticular fibrosis and edema without gastrocnemius tendon rupture; however, I am seeing more edema of the shank accompanied by rupture or laxity of one or more of the digital flexor tendons. In the last two years a greater percentage of these TARV cases have complication with bacterial infection- Escherichia coli and Staphylococcus. In some of these affected hock joints one might observe marked erosion of the articular cartilage of the tibiotarsus (drumstick).

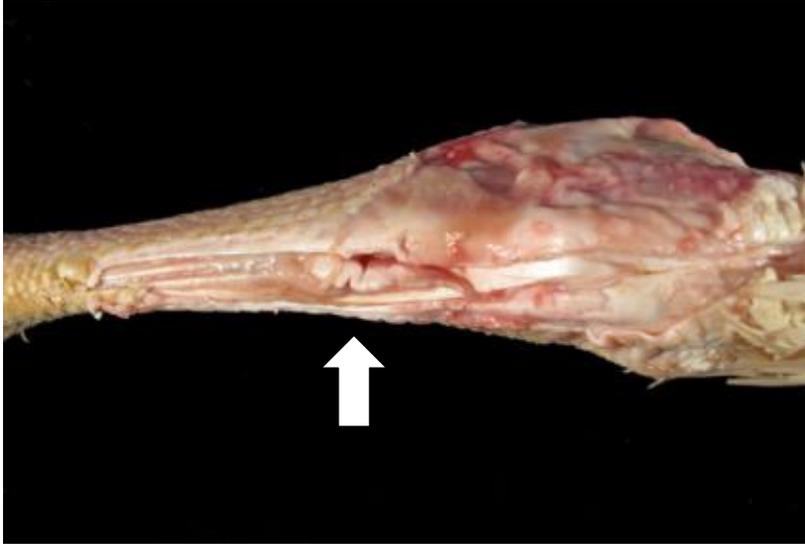


Figure 4. Fifteen-week-old tom turkey that is positive for reovirus: In some instances the lameness is associated with swelling of the proximal shank and rupture of one or more digital flexor tendons (arrow).

Chicken reovirus has been known to cause lameness in broiler and layer chickens for many years. Does the turkey reovirus cause lameness in chickens? We have challenged one-week-old chicks with several TARV isolates and followed them to five weeks of age. TARV did not induce tenosynovitis by oral or intratracheal routes in chickens; however, one TARV isolate did induce tenosynovitis after footpad inoculation. We do not know the long term effects of TARV in chickens, but our initial impression is that chickens are not susceptible by natural routes of infection.

Summary: The University of Minnesota TARV Research Group has created the following **case definition** for turkey reoviral arthritis/tenosynovitis.

Turkey reoviral arthritis is a progressive condition that appears as early as 10-12 weeks of age in male, and sometimes female, commercial turkeys. Signs are most severe when the birds reach 15-16 weeks of age. Clinical signs are characterized by reluctance to move, recumbency and limping on one or both legs. There is often uni- or bilateral swelling of the hock (intertarsal) joint. Morbidity can be as high as 40% and mortality is usually a result of culling or aortic rupture. Lesions observed in acutely affected birds at necropsy are uni- or bilateral enlargement (subcutaneous edema) of the hock joints, which contain increased volume of clear yellow to serosanguinous synovial fluid. Similar fluid can expand the sheath of the gastrocnemius and digital flexor tendons. In chronic cases there is bruising of the skin of the hock, with prominent periarticular fibrosis, edema and occasional large flecks of fibrin within

the subcutis and tendon sheaths. In a small percentage of cases one can observe partial or complete rupture of the proximal gastrocnemius tendon or a digital flexor tendon with hemorrhage at the level of the rupture. Histological sections of gastrocnemius tendon and sheath reveal lymphocytic infiltrates in the subsynovium in acute cases, progressing to prominent subsynovial and peritendon fibrosis in chronic cases. Secondary bacterial infections (e.g., *Staphylococcus*) occasionally occur and are accompanied by heterophilic inflammation. Definitive diagnosis requires ruling out other causes of lameness in turkeys (e.g., osteomyelitis, primary bacterial arthritis, muscle rupture, footpad dermatitis, *Mycoplasma synovitis*) and isolation of reovirus, referred to as turkey arthritis reovirus (TARV), from the gastrocnemius and/or digital flexor tendon in embryonated eggs or cell culture.

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