Equine Rhinitis Viruses: The Upcoming Respiratory Pathogens

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1. Introduction and Epidemiology

Equine rhinitis viruses (ERVs) are an important cause of acute respiratory disease in horses across the globe, with cases previously reported in Australia, North America, Europe and Asia.1–5 Equine rhinitis A and equine rhinitis B viruses (ERAV and ERBV, respectively), formerly called equine rhinoviruses-1 and 2/3, were originally discovered in the 1960’s (ERAV) and 1970’s (ERBV) and are RNA viruses of the picornavirus family.6,7 ERAV is of the genus aphthovirus and is closely related to foot-and-mouth disease virus, whereas ERBV is the sole member of the genus erbovirus.8–10 Only one serotype of ERAV has so far been identified; however, three distinct serotypes of ERBV have been isolated: ERVB1.1436/71, ERBV2.313/75, and ERBV3.11,12 Initial infection with ERVs results in local viral reproduction in the nasopharynx. In ERAV, this is followed by a viremia lasting 4–5 days.13 Transmission between horses occurs primarily through close contact and inhalation of respiratory droplets; however, indirect transmission through contaminated equipment or waste from infected horses may also occur. As with other viral respiratory pathogens, shedding occurs from the nasopharynx; however, shedding through urine and feces may also play a significant role in allowing ERVs spread through a facility.13–15 This shedding may persist in some horses long after clinical resolution. A study by Lynch et al, 2013 found high levels of ERAV shedding in urine persisted for at least 37 days post-infection (the length of the study).15 Interestingly, a case study by Johnson et al, 2012 also found ERAV in a semen sample from a healthy stallion, although the significance of this finding for viral transmission is unknown.16 Since their discovery, the contribution of ERVs to the burden of equine respiratory disease has been unclear. Several studies investigating the seroprevalence of ERVs have found that a high proportion of mature performance horses had serum neutralizing antibodies to ERAV (~37–75%), and ERBV (~50–80%).10,17–19 Seroprevalence in some populations was even higher; for example, a study of 200 clinically healthy horses stabled across Austria found seroprevalences of 90% and 83% to ERAV and ERBV, respectively. Many foals acquire passive immunity to ERVs from their dams at birth, but immunity wanes significantly by 5–6 months of age and, in the case of ERAV, may disappear completely at 10–12 months.18 Many horses seroconvert to ERAV as yearlings and 2-year-old’s, often coinciding with introduction into training facilities.2,20,21 ERAV seroreversion is not typically observed after initial infection suggesting immunity is long-lasting.18 In contrast, seroconversion to ERBV can happen at an earlier age (<6 months) than ERAV and, as there may be overlap in time between the presence of maternal antibodies and actively acquired immunity due to exposure, interpretation of changes in titer may be difficult. Unlike ERAV, ERBV seroreversion is commonly observed and
repeated episodes of reinfection or recursion may occur throughout a horse’s life. Seroprevalence studies suggest ERV infections are common throughout the world. However, their importance as a cause of acute respiratory disease in horses has often been overlooked due to several factors. While many performance horses are seropositive for ERVs, these viruses are rarely isolated from clinical cases of acute respiratory disease. This discrepancy may result from the well-documented difficulties in isolating ERVs using standard virus isolation techniques. The reason for this difficulty is unclear. ERVs cases may go undiagnosed, or be attributed to other respiratory pathogens. To further confuse the issue, ERVs have been recovered in clinically healthy horses and are frequently found in combination with other viral or bacterial pathogens. These findings suggest the principal role of ERVs may be to increase the severity and duration of other respiratory diseases through co-infection, rather than as stand-alone pathogens. However, previous studies have documented outbreaks of acute respiratory disease caused by ERVs without coinfection with other pathogens. Occurrence of clinical disease often coincided with entry into training yards. These findings are not surprising as horses are often transported to training facilities and/or yearling sales as yearlings or 2-year-olds and encounter an increased number of other horses and handlers. Clinical cases varied widely in severity, with some horses exhibiting mild respiratory signs lasting 1-3 days and others experiencing more severe signs lasting several weeks. Probability of severe disease was found to be highest in yearlings and 2-year-olds. Age, number of horse-to-horse contacts, and the stress of transportation and/or early training have all been suggested to increase susceptibility to ERVs and other respiratory pathogens. Therefore, while ERVs may not represent a common source of morbidity in mature horses, evidence suggests these viruses significantly contribute to the burden of respiratory disease in young animals, particularly those in performance disciplines.

2. Clinical Presentation
Clinical disease is characterized by a febrile period of 1–3 days, cough, anorexia, serous nasal discharge, which progresses to mucopurulent, and enlargement of the lymph nodes of the head and neck. Distal limb edema is also occasionally observed. These infections are usually transient; however there is wide variation in the duration and severity of clinical signs with a small proportion of horses experiencing prolonged illness. An experimental study of ponies inoculated with ERAV found that in addition to upper airway signs, clinical cases also developed adventitial lung sounds and mucopurulent discharge in the lower airways on endoscopic examination. These findings suggest ERAV infection is not confined to the upper respiratory tract. In addition to clinical illness, ERAV infections are a source of missed training days and failure to race. In an outbreak of ERAV in 51 yearlings stabled at a Standardbred training facility, clinical signs persisted for 1–>40 days, and 6 horses were removed from training for 8–12 weeks due to the severity of their condition. Subclinical ERV infection and seroconversion has commonly been observed in stables experiencing outbreaks.

3. Diagnosis
Laboratory diagnosis of ERAV and ERBV can be made by measuring antibody titer in paired acute and convalescent sera. Serum samples should be taken at the onset of clinical illness and 2–3 weeks post-infection. Antibody titer is commonly measured using standard viral neutralization assays; however, enzyme-linked immunosorbent assays (ELISAs) have recently been introduced. As there is evidence of persistent shedding of ERVs after clinical resolution, use of paired titers can distinguish between acute and chronic infections by detecting the timing of seroconversion. Due to the high seroprevalence of the ERVs in mature horses and the high titers observed in horses previously infected with ERAV, increases in antibody titers may not occur with future exposures. Therefore, caution should be used when interpreting serology data from mature horses. Several studies have reported difficulties in isolating ERVs from nasopharyngeal swabs using standard virus isolation techniques. The reason for this difficulty is unclear; however, there is some evidence that choice of rapidly dividing cell cultures and addition of MgCl₂ enhances the growth of ERBV serotypes, thereby improving diagnostic sensitivity. Given the poor diagnostic sensitivity of virus isolation, and the documented isolation of ERVs from clinically healthy horses, use of virus isolation alone as a diagnostic tool is not recommended. However, it may be a useful adjunct to other tests. In recent years, reverse transcriptase polymerase chain reaction (RT-PCR) has been used to detect ERVs from nasopharyngeal or urine swabs with improved sensitivity over virus isolation, and 100% specificity. Another advantage of RT-PCR is its shorter turnaround time compared to virus isolation or serology, allowing for more rapid diagnosis. Given the difficulty of isolating ERVs and the occurrence of persistent viral shedding, it is recommended that practitioners use serology alone or in combination with RT-PCR as a means of diagnosis.

4. Treatment
As with other viral respiratory diseases, treatment is largely supportive. Anti-inflammatories can be administered to reduce inflammation and discomfort. Antibiotics are not indicated unless
there is evidence of secondary bacterial infection. Horses should be rested for at least two weeks, although a previous study investigating plasma fibrinogen in ERAV cases found that levels remained increased 4-6 weeks postinfection, even in uncomplicated cases. Therefore, the duration of systemic recovery may necessitate longer periods of rest before horses return to their full training regime, to prevent potential complications. Early return to training may prolong duration of clinical signs and increase the risk of complications such as bronchopneumonia.

5. Prevention

There are currently no approved vaccines against ERBV; however, a vaccine against ERAV has been developed by Boehringer Ingelheim Animal Health and been granted a license for conditional use by the USDA where there is demonstrated need. Even so, to date no studies have been published demonstrating the efficacy or safety of this vaccine and therefore, its usefulness in preventing ERAV is unknown. Implementation of effective farm level biosecurity and disinfection protocols is the best approach to prevent the introduction and spread of ERVs in stables. These protocols should include quarantining or cohorting new or returning horses by date of entry or seller, before allowing them to mix with other animals in the facility. In the event of an outbreak, sick horses should be stabilized in isolation stalls away from healthy horses where possible. In addition, disinfection of common surfaces and equipment, staff hygiene, and proper waste management will reduce the chance of transmission between animals. Although there are no published studies on the persistence of ERVs in the environment, other picornaviruses such as foot and mouth virus can survive on surfaces for at least two weeks, although a previous study investigating plasma fibrinogen in ERAV cases found that levels remained increased 4-6 weeks postinfection, even in uncomplicated cases. Therefore, the duration of systemic recovery may necessitate longer periods of rest before horses return to their full training regime, to prevent potential complications. Early return to training may prolong duration of clinical signs and increase the risk of complications such as bronchopneumonia.

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Declaration of Ethics

The Author has adhered to the Principles of Veterinary Medical Ethics of the AVMA.

Conflict of Interest

The Author has no conflicts of interest.

References


