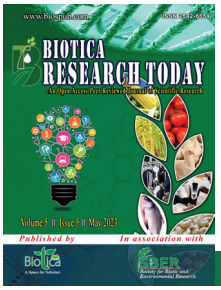
Bio. Res. Today 2023, 5(5):349-351



Biotica Research Today

e-ISSN: 2582-6654

May, 2023

Article ID: RT1300 **Popular Article**

Equine Herpesviruses: An Overview

Avani R. Modi* and Bharat B. Bhanderi

Dept. of Veterinary Microbiology, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Anand, Gujarat (388 001), India

Open Access

Corresponding Author

Avani R. Modi

✉: avanimodi52581@gmail.com

Conflict of interests: The author has declared that no conflict of interest exists.

How to cite this article?

Modi and Bhanderi, 2023. Equine Herpesviruses: An Overview. *Biotica Research Today* 5(5), 349-351.

Abstract

Two most frequent causes of fever rhino pneumonitis in horses are EHV-1 and EHV-4 viruses. In some regions, EHV-1 is also a significant contributor to myeloencephalopathy respectively outbreaks and abortions. Aerosolized viral particles can spread illness when inhaled, and viruses mostly harm the uterine, pulmonary, and spinal cord mucosa, causing rhinopneumonitis, abortion, and myeloencephalopathy. Real-time PCR is now regarded as the gold standard for diagnosis, replacing viral isolation, which was once thought to be the gold standard due to the development of improved molecular techniques. The whole genome sequencing data is available for EHV 1, 2, 3, 4, 8, and 9.

Keywords: Diagnosis, EHV, Genome, Latency

Introduction

In nature, herpesviruses are common and have a diverse spectrum of hosts, including insects, reptiles, amphibians, and every type of mammal and bird. Every species of Equidae in nature is infected by at least 14 different herpesviruses. *Equine herpesvirus* (EHV) 1 and 4 are the two most widely researched of the 14 herpesviruses that infect horses. Coital exanthema, neurological disease, respiratory disease, and abortion are among the sporadic disorders in horse populations that are associated with equine herpesvirus infections. EHV-1 infection in horses typically causes upper respiratory tract infections in young horses, abortions that typically occur in late gestation, and myeloencephalopathy in older horses.

History

The virus was previously known as the "equine abortion virus" before being relabeled "*equine herpesvirus type 1.*" In cases of abortion and paralysis, EHV-1 was initially discovered in 1966. Nine equine herpesviruses have so far been identified, including EHV-1. Firstly identified EHV-1 in the year 1930, and after that subsequently identified EHV-2, -4, -3, -5 in 1963, 1981, 1986, and 1988 respectively. In India, EHV-1 was identified in the year 1965.

Classification

The *Herpesvirales* order is organized into three families (the *Herpesviridae*, the *Malacoherpesviridae*, and the *Alloherpesviridae*) by the Herpesviridae study group. More than 100 members of the order inhabit a variety of hosts, including birds, amphibians, reptiles, invertebrates, humans, and other mammals. Mammal, reptile, and bird viruses are members of the *Herpesviridae* family; fish and amphibian viruses are members of the *Alloherpesviridae* family; and the invertebrate bivalve mollusk virus is a member of the *Malacoherpesviridae* family. The *Herpesviridae* family of viruses has been subdivided into subfamilies *Alpha-*, *Beta-*, and *Gammaherpesvirinae* based on the host range, length of the reproductive cycle, cytopathology, and characteristics of latent infection. *Equine Herpesvirus types 1, 3, 4, 6, 8,* and *9* are among many species found in the subfamily *alphaherpesvirinae*, which also comprises the genus *Varicellovirus*. Members of the Percavirus genus and subfamily *Gammaherpesvirinae* include *Equine Herpesvirus-2* and *-5. Equine Herpesvirus-7* is a species that belongs to the same subfamily as the other genus of *rhadinovirus*.

A typical herpesvirus virion is made up of an envelope with spike-like viral glycoproteins on its surface; a structured tegument encircles an icosahedral capsid; a core with linear

Article History

RECEIVED on 17th April 2023 RECEIVED in revised form 03rd May 2023 ACCEPTED in final form 04th May 2023

double-stranded DNA.

Equine Herpesviruses Size and Their Genomic Information based on the WGS

EHV-1, -2, -3, -4, -8, and 9 have 150, 184, 151, 145, 149, and 148 kbp sizes respectively. EHV-1, -3, -8, and 9 have 80 Open Reading Frame (ORF) and 76 genes (Telford *et al.*, 1992; Liu *et al.*, 2012; Fukushi *et al.*, 2012). EHV-2 has 79 ORF and 77 genes. EHV-4 has 79 ORF and 76 genes (Telford *et al.*, 1992).

Latency

The latency period of the herpesvirus life cycle occurs after the first infection when the spread of virus-particles stops. But the viral genome is not destroyed. The virus can reactivate and the host can be re-infected. Latently infected horses are the principal reservoir of EHV. Even though viral DNA transcription is restricted during latency, the entire viral genome is present in all nine host cell nuclei. Due to this, immunological surveillance is unable to detect the infection. After the EHV infection lasts the rest of the host's life, it frequently causes latent infection in lymphoid and neuronal tissues. Weaning, transportation, concurrent infections, corticosteroids, and other stressful situations are among the physiological elements that cause the dormant virus to become active. Latency sites for EHV-1, 2, and 4 include the lymphoreticular system and trigeminal ganglion, whereas Langerhans cells, macrophages, and B lymphocytes are present in the latency sites of EHV-1 and EHV-4.

Transmission

EHV-3 infection is transmitted through direct contact between the skin of two horses during mating or through secretions containing live viruses. In contrast, EHV-1, 2, 4, and 5 infections occur through inhalation of aerosolized infectious viruses, direct nose-to-nose contact, or contact with contaminated objects. Transmission can occur *via* direct contact, contaminated objects, airborne particles, oral ingestion, mechanical vectors, or biological vectors. EHV infections exhibit epidemiological traits such as the high occurrence of respiratory infections at an early age, typically with low morbidity. Many infected horses develop lifelong latency, and the reactivation of latent viruses can lead to viral shedding, causing transmission to other horses that may be unaware of their exposure.

Pathogenesis

When EHV-1 and EHV-4 infect the respiratory epithelium, various herpetic lesions develop in the upper respiratory mucosa. Within 24-48 hours of infection, EHV-1 can be detected in the respiratory tract's lymph nodes, where it replicates and spreads from cell to cell, infecting leukocytes. The virus can then travel to other sites, such as the eye, central nervous system, and endothelial cells in the pregnant uterus, via a cell-associated viremia.

Clinical Signs

A short time of incubation, followed by an increase in body temperature (38.9-41.0 °C), appetite, nasal discharge, pharyngitis, depression, swollen submandibular lymph nodes, and irregular ocular discharge, are characteristics of infection. Coughing is a minor symptom of uncomplicated equine herpesvirus respiratory illness in affected horses, though it does occur occasionally.

The most frequent virus that causes abortions in pregnant mares is known to be EHV-1. Signs of Equine Herpesvirus Myeloencephalopathy (EHM) include a history of fever, abortion, or respiratory disease among horses on the property, along with the rapid onset of symptoms such as ataxia, paresis, and urine incontinence. EHV-1 infection of the ocular endothelium can lead to chorioretinopathy, which results in permanent "shot-gun" vision impairment (Dubale, 2017).

Diagnosis

To detect EHV infections, various diagnostic tools are utilized, including virus isolation, immunofluorescence, PCR-based assays, and serologic examinations. For laboratory diagnosis of EHV infections, virus isolation continues to be the "*gold standard*". In addition to horse skin cells and equine embryonic lung cells, a variety of cell lines can be used to isolate EHVs. When cytopathic effects (CPE) manifest in inoculation cultures, an EHV isolation is considered to be positive. Usually, cytopathic effects (CPE) resulting from EHV-1, -3, and -4 can be detected within 5-7 days of culturing, while CPE caused by EHV-2 and -5 is generally observable after 3-4 passages.

Utilizing 11-13-day-old embryonated chicken eggs that were specifically pathogen-free (SPF), Ali *et al*. (2020) performed virus isolation. The CAM method was used to inject a total of 150 µl filtrated samples into chicken embryonated eggs, which were then incubated at 37 °C for five days. The egg was examined twice daily. A death that occurs more than 24 hours after the vaccination is regarded as non-specific. A pock lesion caused by the CAM's cytopathic effect (CPE) appears five to six days after the CAM and fluid were aseptically extracted following three passages. CF, ELISA, and VN tests are employed to diagnose diseases by analyzing the blood serum.

Prevention and Control

Vaccination

The use of vaccinations is essential for the prevention of infectious diseases. The EHV-1 vaccine aims to lessen the amount of virus that multiplies in the respiratory tract after infection, which will decrease nasal shedding, the occurrence of respiratory problems, the occurrence of abortions, and the occurrence of nervous system diseases. Currently, modified live virus and inactivated vaccines against EHV-1 and EHV-4-induced illness are available. In-depth research is still being done to provide better vaccinations, such as DNA and recombinant vaccines against EHV-1 and 4. EHV-2, 3, and 5 infections cannot currently be prevented by commercially available vaccinations.

Biosecurity

To prevent physiological stress in horses, it's important to follow good husbandry practices. To minimize the spread of disease, resident horse populations should be divided into small, self-contained groups. New horses should be isolated in a separate barn or paddock. Additionally, it's

recommended to monitor the rectal temperatures of horses daily, ideally twice, to ensure they fall within the normal range of 99 to 101.5 °F. Horses exhibiting clinical symptoms need to be kept apart right away so a vet can examine them. To maintain herd immunity and reduce the spread of EHV, it's important for all horses to receive routine vaccinations. Employing barrier precautions, using foot baths, and practicing proper hand hygiene can also aid in preventing the transmission of infectious diseases.

Conclusion

Horse populations around the world are impacted by EHV infections, which are intermittent in nature and result in significant financial losses. EHV is enveloped, dsDNA, and icosahedral capsid which is surrounded by a tegument layer and possesses latency. Sub-family *Alphaherpesirinae*, Genus *Varicellovirus* contains the species EHV-1, 3, 4, 6, 8, and 9. Sub-family *Gammaherpesvirinae*, Genus *Percavirus* contains the species EHV-2, 5, and Genus *Rhadinovirus* contains EHV-7. EHV-1 to EHV-5 infects horses. Asinine herpesvirus (AHV) 1 to 6 infects donkeys. EHV-9 also infects donkeys. EHV infections are highly contagious and transmitted through inhalation, coitus, aborted fetus, feed, water, and fomites. The respiratory, reproductive, nervous, and cutaneous are forms of EHV that cause *rhino pneumonitis*, abortion storm, equine myeloencephalopathy, and coital exanthema, respectively. Laboratory diagnosis of EHV is carried out using virus isolation, PCR, and serological tests. Strategies of vaccination, biosecurity measures, and strict hygiene can prevent EHV infection.

References

Ali, A.A., Refat, N.A., Algabri, N.A., Sobh, M.S., 2020. Fetal lesions of EHV-1 in equine. *Anais da Academia Brasileira de Ciências* 92(Suppl 2), e20180837. DOI: https://doi.org/10.1590/0001-3765202020180837.

Dubale, H.N., 2017. Epidemiology of equine herpesviruses in Ethiopian equids and invasion characteristics of EHV-1 and EHV-3 in respiratory and genital mucosae. *PhD Thesis*. Ghent University. Faculty of Veterinary Medicine, Merelbeke, Belgium. pp. 1-150. URL: http://hdl.handle.net/1854/LU-8502446.

Fukushi, H., Yamaguchi, T., Yamada, S., 2012. Complete genome sequence of *equine herpesvirus type 9*. *Journal of Virology* 86(24), 13822. DOI: https://doi.org/10.1128/JVI.02607-12.

Liu, C., Guo, W., Lu, G., Xiang, W., Wang, X., 2012. Complete genomic sequence of an *equine herpesvirus type 8* Wh strain isolated from China. *Journal of Virology* 86(9), 5407. DOI: https://doi.org/10.1128/JVI.00445-12.

Telford, E.A., Watson, M.S., McBride, K., Davison, A.J., 1992. The DNA sequence of *equine herpesvirus 1*. *Virology* 189(1), 304-316. DOI: https://doi.org/10.1016/0042-6822(92)90706-U.