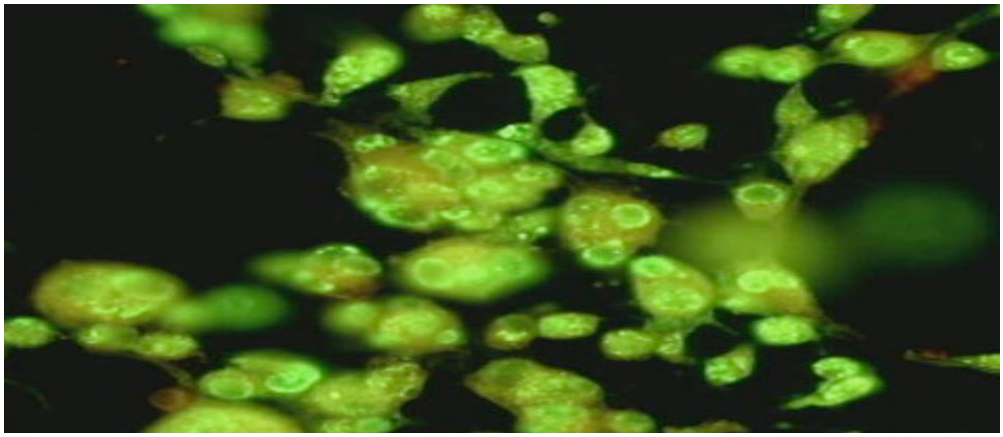
Equine Herpes Virus (EHV)



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Introduction:

In the world of horses, there is a never-ending stream of health considerations to be aware of and alert to. We all want what's best for the animals in our care, and becoming informed is an essential part of this desire. Chances are, if you are reading this article you have heard of Equine Herpes Virus (EHV) in some form or setting. Perhaps, in light of the newest outbreaks and the resultant media attention, you are concerned and want information. Or perhaps you are alarmed by the current risk level your horse is facing and want to know how you can best protect him or her.

Accordingly, the primary goal of this article is to educate you about EHV, including the mode of transmission, the primary and secondary symptoms, the treatment options, applicable vaccinations and, ultimately, what you can do to prevent your horse from contracting the disease. Whichever of the numerous reasons you may have for reading on, after reading this piece you will emerge informed and educated in regards to this dynamic disease.

Basic Information:

Equine Herpes Virus (EHV), from the family *Herpesviridae*, is comprised of five distinct strains. Equine Herpes Virus-1 and Equine Herpes Virus-4 represent the most common presentations of the disease: respiratory tract disease, spontaneous abortion, neonatal mortality, and neurological disease. These are also the most established strains and consequently are the most often referenced and discussed.

The Gluck Equine Research Facility of University of Kentucky, Lexington, cites EHV (EHV-1 in particular) as "unique in its ability to target and attack three separate organ systems of the horse (respiratory, reproductive, and central nervous systems)." Once a horse contracts Equine Herpes Virus he or she has the virus for life. No method exists which will eradicate the disease, but extended periods of latency (viral dormancy) are commonly observed in one's horse.

- Equine Herpes Virus-1 is characterized by three distinct strains:

    1. EHV-1 Abortion Strain: Causes spontaneous abortion in a mare who becomes infected while pregnant. The virus also affects the foals, who subsequently become infected. These foals are sick immediately post-birth or become ill one to two days following. Generally, foals succumb quickly to EHV-1 and are largely unresponsive to medical interventions. Sadly, the end result is often death.
    2. EHV-1 Respiratory Disease Strain: Leads to respiratory distress, namely upper respiratory tract infections and pneumonia. Contracting the virus can also result in encephalitis (inflammation of the brain). More commonly, infection results in significant destruction of the epithelium in the respiratory tract but is generally non-fatal. This strain is commonly referred to as rhinopneumonitis or simply rhino. A vaccine, which many horses receive as part of their yearly vaccination

regimen, is readily available which serves to confer immunity. Therefore, you have likely heard of this form of EHV already.

3. EHV-1 Myeloencephalitis: This strain is the neurological form, which is thought to be the result of a genetic mutation within the strain. Horses with this form become uncoordinated, weak, suffer from paralysis, and may have difficulty urinating and/or defecating. This form has an elevated level of related mortalities but should not be regarded as absolutely fatal.

Note: EHV-1 Myeloencephalitis does not always occur simultaneously nor does it automatically occur upon EHV-1 infection. EHV-1 and EHV-1 Myeloencephalitis are two distinct forms of the same pathogenic strain. The progression of EHV-1 to EHV-1 Myeloencephalitis begins with the respiratory tract infection and then progresses to the neurological form which manifests itself eight to twelve days following initial infection. The progression detailed here, *can* occur but does **not** necessarily occur in all cases.

- EHV-2 contributes to respiratory disease and manifests itself thorough the easily detectable symptoms of coughing, conjunctivitis, resultant swollen lymph nodes, and a decrease in performance. It is also believed to be a factor affecting the reactivation or exacerbation of EHV-1 and EHV-4 strains.
- EHV-3 is a direct contributor to the development of equine coital exanthema, a disease which is contracted by way of direct sexual contact. It manifests itself by way of pustules and sores in the genital region of mares and stallions as well as, theoretically, geldings.
- EHV-4 is cited as the primary cause of rhinopneumonitis, discussed previously. In rare cases this form has been known to cause abortions. The neurological form of EHV is not associated with and almost never results from EHV-4.
- EHV-5 is a respiratory form of the disease which commonly affects foals and yearlings. It is largely isolated to foreign countries such as Switzerland, Germany, Australia and New Zealand. Therefore, EHV-5 has little effect upon the United States.

While these five distinct forms of Equine Herpes Virus exist, the ones that affect the horse community in the most widespread fashion and have the most prominent effects are EHV-1 and EHV-4. Therefore, this article will focus on these forms, with the most emphasis being placed on the most prevalent form, EHV-1.

Latest Outbreak:

Equine Herpes Virus is not an emerging disease, nor is it any new virus to the United State's horse population. Dr. Debra Sellon of Washington State University Veterinary Hospital, asserts that, "As many as 80 percent of horses in the United States have some latent strain of equine herpes virus, but there is no easy way to identify them." This being said, EHV has earned much attention due to the latest outbreak which occurred in late 2006. This outbreak was of the EHV-1 strain, with a high prevalence of horses manifesting symptoms associated with the neurological form.

The epidemic originated from a shipment of fifteen infected horses from Germany. These horses were subsequently transported to eight states. Two of the eight states, Florida and California, reported confirmed cases of EHV-1 Myeloencephalitis. As a result of the original five horses that were shipped from Germany to Florida, thirteen horses were subsequently infected; seven of these horses presented neurological symptoms, and six of those cases resulted in fatalities. Only one horse from this incoming group was shipped to California. It was diagnosed with the neurological form of EHV-1 and, unfortunately, died from the disease. In the other six states that received shipments from Germany, the horses were quarantined and observed for any signs of EHV. None were present.

Quarantines of exposed horses were enacted in Florida and California to minimize the spread of this deadly disease. Other states reported cases, some of which were substantiated, others not. Most recently, both Washington and Oregon have felt the threat and fear associated with EHV when infected horses were suspected to have been brought into and transferred between the states. Many venues decided to postpone or ultimately cancel their shows, and many barns shut their doors to both incoming and outgoing horses. The community, in some areas, was in a veritable lock-down in response to the threat of EHV infection.

Modes of Transmission:

Equine Herpes Virus is transmitted via close proximity with and/or contact with a horse infected with EHV. The virus is shed from an infected horse by way of nasal secretions, commonly referred to as "nasal shedding." Nasal shedding typically occurs during the height of infection: the period where the horse presents elevated temperature. Shedding can continue from fourteen to twenty-one days after the fever has abated.

Generally, in horses that have not previously been infected, shedding of the virus persists for fourteen days. In horses that have been infected previously and have become reactivated carriers, the volume of nasal secretions is decreased and the viral load (the amount of virus contained within the secretions) is significantly reduced.
It is contact with or inhalation of these nasal secretions, which are virus laden, that serves as the mode of transmission. The virus is most communicable within the first few days of the respiratory tract infection.

The most common mode of transmission is aerosol transmission, generally through saliva or nasal secretions which are transferred via direct contact or carried in the air and enter into the nasal passage/mouth of another horse. EHV can only be spread from horse to horse over limited distances, i.e. between stalls, paddocks, and fields; it **cannot** be spread over distances greater than approximately thirty-five feet.

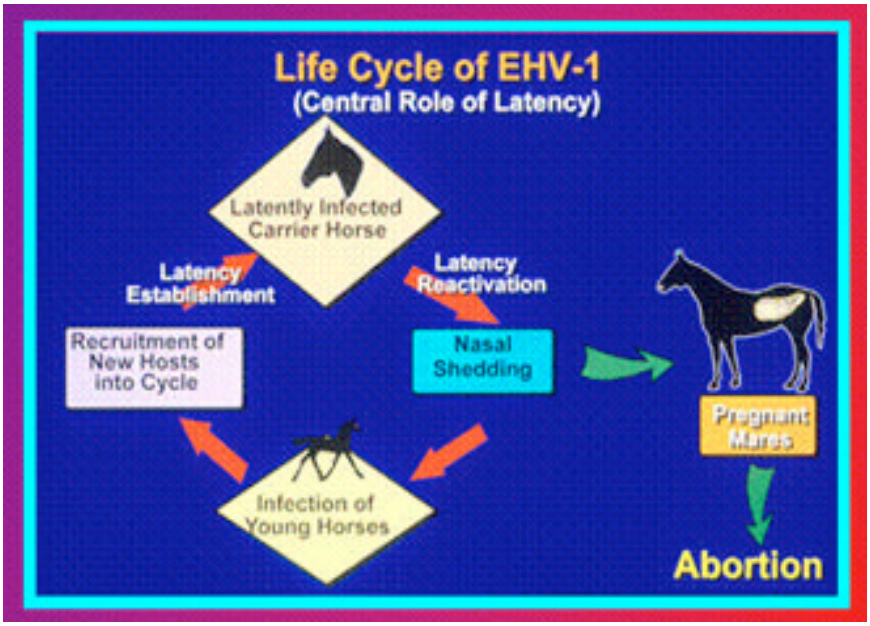
The viruses, which as discussed are present in nasal secretions of actively shedding horses, can become airborne by the coughing, snorting, blowing, etc. of an infected horse. These viruses can then travel to neighboring horses and serve to infect them as well. The only way for EHV to infect a horse is through the mucous membranes of the upper respiratory tract; this is the only place where the virus can gain entry into the horse's system and serve as an infectious agent.

Equine Herpes Virus can also be spread by way of materials/objects used on an infected horse which consequently become contaminated; for example, by way of such objects as

tack, saddle pads, blankets, water buckets, feed buckets, brushes, bits, soiled bedding, etc. Individuals caring for and handling infected horses also serve as prime transporters of the virus, which can cling to clothes, shoes, gloves, etc. Conceivably, poorly sterilized or non-sterilized veterinary materials and paraphernalia could serve to spread EHV as well. Basically, anything that has touched or been involved with an infected, or possibly infected, horse is suspect. You should err on the side of caution when handling such objects.

In regards to the abortogenic strain of EHV, fetal tissue, placenta, amniotic membrane, and secretions from the reproductive tract of a mare post abortion serve as potential sources of infection. Transmission from an EHV-1 infected mare to her foal is also observed. Whether transmission occurs in utero or immediately following birth has not been definitively established.

The EHV virus, which is capable of lying dormant in a carrier horse, can become reactivated. Reactivation results from factors such as stress, thereby causing the virus to become fully activated and infectious.



http://www.ca.uky.edu/gluck/BiblioEHV1.asp#respiratory

As Dr. Debra Sellon of Washington State University explains, “The virus can be latent in a horse for its entire life. But when the horse is under stress, such as from competition or travel, the virus begins to replicate, is shed in nasal secretions, and other horses can be exposed and infected without the original horse becoming sick itself.”

The most alarming and uncontrollable facet of transmission is that numerous horses are latent carriers of the disease and serve as "silent carriers." These horses exhibit no obvious outward symptoms of infection. Nonetheless, they serve as hubs of infection and centers for dispersal of the disease throughout a population.

The Gluck Center at the University of Kentucky quantifies such horses as "…inexhaustible and globally distributed biological reservoir of the virus for continuous transmission of infection among adult horses and to new generations of young horses." The prevalence of such horses is high, their numbers large, and their locations geographically unrestricted; thereby they serve as significant infectious force and potential epidemic source.

Horses at Greatest Risk:

Given that that EHV is generally contracted via aerosol transmission, a horse must be intimately close with an infected horse for them to become infected. Therefore, settings where horses are in close proximity to each other represents an environment with an increased risk of infection. Examples of such locales include shows/conventions, stables/pastures/turn out, trailers/vans, etc.

There is also an increased risk of infection when a new horse arrives at a barn, for he or she could potentially be silent carriers or be actively infected. The same concept applies to a horse arriving at a new barn; a horse currently at the barn could potentially be a carrier or be infected and could transmit the virus to the arriving horse. Therefore, if you are moving your horse to a new barn, or accepting outside horses to your barn, you should be hyper vigilant and aware of any possible signs or symptoms the arriving horse may exhibit.

Weanlings and young horses beginning their training or showing careers are also at increased risk of contracting EHV. Consequently, horses and especially broodmares in contact with these younger horses are also at increased risk. Horses that are older than five years of age appear to be at increased risk for contracting EHV-1 Myeloencephalitis, as compared to their younger counterparts.

Horses being hauled or shipped are also at an increased risk, especially horses being hauled commercially. This is due to the fact that such horses are in tight quarters with others who serve as potential carriers. Due to decreased air circulation inherent in trailers and a horse's increased propensity to snort and blow in such a setting, the availability for the virus to be transmitted into the air and infect a nearby horse is greatly increased. Additionally, the stress of hauling and traveling is associated with suppressed immune ability and therefore is related to an increase in susceptibility to infection.

A show or exhibition is also an ideal setting for transmission. This is due to the sheer number of horses and the variability in locales from which they originated. As with any barn setting where stalls are butted up next to each other, show stabling provides ample opportunity for the virus to spread and infect numerous horses with little barrier to prevent it. The show setting is arguably one of the highest risk situations, for it combines the increased risk associated with both hauling and barn situations.

Those horses that have been previously infected with EHV-1, as compared to those contracting the disease for the first time, are at a greater risk for contracting the neurological form and developing the characteristic symptoms. Pregnant mares are also at an increased risk for contracting EHV-1 Myeloencephalitis. The prevalence of the neurological form appears to be linked to epidemics of the abortigenic form of EHV-1. Mares contract Myeloencephalitis at an increased rate following these instances. That being said, mares that contract EHV-1 while pregnant, resulting in abortion of the fetus, are not reproductively compromised. They show no signs of reproductive trauma, are able to conceive following the incident, carry foals to term, and ultimately give birth to healthy foals.

Signs and Symptoms:

A solid method by which to detect EHV infection is monitoring the horse's temperature. An elevated temperature is generally a good indication of an infection, be it EHV or otherwise.

The strain specific symptoms are as follows:

- EHV-1 Respiratory Disease: While the incubation period for this strain is two to ten days, clinical symptoms generally appear three to six days following exposure to, and subsequent infection with, EHV-1. Common manifestations include: elevated temperature, i.e. a fever registering between 102° and 107° Fahrenheit, marked decrease in neutrophil (a type of white blood cell) and lymphocyte count, nasal discharge from both nostrils, painful inflammation of the pharynx (a.k.a. sore throat), cough, decreased or lack of appetite, and depression. The symptoms associated with the respiratory disease are largely mild and pose no immediate health risk in and of themselves.

- EHV-1 Myeloencephalitis: The neurological form manifests itself following initial exposure to the virus via the respiratory tract and/or manifestation of the respiratory form of the disease. The symptoms usually present themselves the second week (generally between eight and ten days) following such an incident, and proceed to reach peak intensity within forty-eight hours.

The commonly observed symptoms are weakness and/or paralysis of musculature in the hind legs, which causes a lack of coordination, aberrant gaits, and recumbency (inability to remain standing on all four legs). Many times this weakness results in an inability to rise from a sitting, or in extreme cases, a prone position. The observed paralysis can, in severe cases, progress into quadriplegia, and ultimately result in death of the horse. Additional symptoms include toe dragging, loss of function in the tail, loss of bladder control leading to dribbling of urine, loss of sensation in the genital region, and an

inability to pass urine and/or feces. Such neurological symptoms directly result from inflammation and subsequent damage to the blood vessels within the central nervous system.

EHV-1 Abortion: Infected broodmares rarely show any prominent or characteristic signs of having contracted the virus. Consequently, the abortion occurs suddenly and without any prior warning. Such an abortion generally occurs between two and twelve weeks post infection. The period of incubation required for the virus to have abortogenic effects ranges from seven days to several months post exposure to the virus. Most abortions happen during the last four months of pregnancy, placing the incident between the seventh and eleventh month of gestation.

The instance of EHV-1 induced abortion is usually limited to one or two mares in a group, although epidemics (commonly referred to as "abortion storms") have been known to ravage brood mare populations and their potential offspring. Mares that become infected with EHV-1 late in the gestation period may not necessarily abort the fetus, but will give birth to live foals. These foals are usually gravely ill at birth or immunologically deficient and become ill within one or two days post birth.

EHV-1 In Newborn Foals: Foals are infected either in utero or immediately contract the virus from their dams at birth. It has not yet been determined which is the main mode of transmission. The observed symptoms are failure to nurse, lethargy, fever, hypoxia, low white blood cell count, and demonstrations of respiratory distress. The progression of the disease is accelerated in newborn foals, as exemplified by symptoms manifesting and worsening rapidly. Foals are largely unresponsive to intensive medical attention. EHV-1 infection in newborns usually culminates in viral pneumonia, leading to respiratory failure and ultimately death within a few short days. Sadly, the prognosis for infected foals is always dire, with the majority of the cases resulting in fatalities.

Testing and Diagnostic Means:

Based solely on clinical presentations, one cannot distinguish between equine viral rhinopnuemonitis, equine influenza, or equine viral arteritis, making the diagnosis of EHV significantly more complicated than a cursory examination. A definitive diagnosis demands collection of the virus via a nasopharyngeal swab (nasal swab) or citrated blood sample drawn. This sample must then undergo virus isolation and subsequent analysis in a laboratory setting.

Historically, identification of the neurological form of EHV-1 was based solely off of clinical presentations until an autopsy could be conducted. The presence of vascular lesions on central nervous system tissue sections served as unquestionable indicators of infection. Most recently, the detection of the neurological form of EHV-1 has been made possible by a specific assay known as the Real-Time TaqMan® Polymerase Chain Reaction (PCR). By sending a nasal swab and a blood sample to a laboratory which can perform this specific PCR, the neurological strain of EHV-1 can be differentiated from the non-neurological form. This delineation is based upon genetic deviancies, located within the polymerase gene, between the neuropathogenic and non-neuropathogenic strains.

Diagnosis of EHV-1 related abortion is through examination of the aborted fetus. The presence of apparent or microscopic lesions in the fetus, isolation of the virus in fetal blood, and the presence of the viral antigen in fetal tissues, all serve as clear indications of an EHV induced abortion. It should be noted that analysis of blood samples obtained from a mare post-abortion have little to no diagnostic value.

Treatment Methods:

No specific treatment exists for EHV-1. Most treatment regimens are comprised of a) supportive care, i.e., IV fluids, catheterization, antibiotics, drugs to abate elevated temperature, etc., b) ample rest, to reduce the risk of complicating secondary bacterial infections, and c) reduction of stress, to decrease shedding potential which could lead to further infection of the horse population. Antibiotics may be used to treat secondary bacterial infections. Since EHV is a virus, antibiotics will have no effect upon this primary infection.

Horses with EHV-1 Myeloencephalitis may become recumbent for extended periods of time, requiring mechanical support in the form of slings or suspension to remain standing. These horses require significantly more supportive care so as to minimize the risk of pneumonia, blood clots, congestion, ruptured bladder, loss of strength in the bowel muscles, and scalding. Such complications are the result of being recumbent for extended periods of time. Anti-inflammatory drugs are often employed to reduce the swelling surrounding the spinal cord, subsequently minimizing any lasting damage. Horses that remain standing or are merely recumbent for two to three days have a good chance of survival. Prognosis for those that remain recumbent for longer than three days is generally bleak.

Recently, the drug Acyclovir, originally synthesized for use on humans, has been instituted as a valid method of treatment. Acyclovir is an antiviral drug which acts by retarding the spread of the virus and was devised as a treatment regimen for herpes simplex virus. While Acyclovir has only recently been approved for equine use, the results of its effectiveness in conjunction with EHV are promising.

Available Vaccinations:

The types of vaccinations available for use with EHV fall into two categories: a) modified live vaccines, and b) inactivated vaccines. Both vaccinations are administered via intramuscular (IM) injection. Numerous drug companies have licensed vaccinations for the respiratory and abortogenic strains of EHV-1.

Those which are currently circulating on the market include:

- Two, single component, inactivated vaccines:
    - Pneumabort K and Prodigy
- Three, multi-component, inactivated vaccines:
    - Prestige, Calvenza, and Innovator
- One modified live virus vaccine:
    - Rhinomune

The immunity gained through vaccination usually only lasts two to four months. Therefore, it is suggested that horses which are traveling often reside in a location where horses are frequently being introduced or reintroduced be vaccinated every 90 to 120 days.

The modified live virus vaccination is suggested for prevention of the EHV-1 or EHV-4 induced respiratory disease. The single component inactivated from of the vaccine is recommended for prevention of the abortogenic strain. The vaccine should be administered at three, five, seven, and nine months of pregnancy for maximal affectivity.

One of the newest drugs on the market, Zylexis, was introduced by Pfizer in February of 2006. Zylexis is an inactivated from of the parapox ovis virus and functions by way of immunomodulation (alteration of the immune system). While this vaccination cannot prevent a horse from contracting the virus, it reduces the symptoms associated with it, most specifically those of the upper respiratory tract.

Zylexis, according to Pfizers research, "…prepares the horse's immune system to function more efficiently against Equine Herpesvirus-1 and -4 (EHV-1 and EHV-4) pathogens…" It is currently being marketed specifically for its efficacy in reducing symptoms associated with EHV-1 and EHV-4 related upper respiratory infections.

Note: A vaccination should **not** be administered if the horse has already been exposed to EHV Myeloencephalitis. Vaccination post exposure has been linked to an increase in severity of the infection and exacerbation of neurological symptoms. The verdict is still out on the topic and this recommendation is a current source of debate. But, in erring on the side of caution, one would advise against vaccination.

Currently, there is no vaccination that has proven effective against the neurological form of the virus. There actually appears to be an opposite trend, as vaccination for EHV-1 and EHV-4 has been cited as a risk factor for and a predisposing factor towards contracting the neurological form. The evidence for this assertion is not definitive and the link between the two instances currently remains a hypothesis.

None of these vaccinations confer protection from contracting EHV-1 or EHV-4, i.e., becoming primarily infected, nor do they confer protection against the establishment of latent carrier state. The vaccinations that are currently available do, despite their shortcomings, diminish the presentation and severity of clinical symptoms (excluding those associated with Myeloencephalitis). Additionally, they serve to reduce the amount of viral shedding experienced by horses that have already contracted the virus or contract the virus despite the vaccination. Antigenic variability (constant morphing and changing of the virus) is also a significant issue with the available vaccines. The vaccines that are currently available do not necessarily protect against/are not necessarily effective against all mutations to which the horse could be exposed.

Clearly, vaccination is not an absolute method by which to prevent infection. It is merely a way to reduce symptoms and provide some damage control. The issue with vaccination is compounded by the fact that most adult horses have already been exposed to EHV-1 or EHV-4, thereby attaining latent carrier status. Vaccination will not eradicate the virus in such horses, but may help contain the spread of the virus to non-infected horses by way of reducing the amount of nasal shedding.

Management and Containment:

Minimizing the effects of an EHV outbreak depends on strict adherence to biosecurity and isolation measures. Sick horses should be isolated from the general horse population to prevent the spread of the virus to healthy animals. Exposed horses should also be segregated and immediately quarantined so as to reduce the potential of spreading the virus. As a preventative measure, pregnant mares and mares with nursing foals should be maintained in an isolated area well away from other horses as well.

All horses that are arriving at a new locale should, when feasible, be maintained separately from the existing horse population for a period of twenty-one to twenty-eight days. Because the virus spreads by way of airborne particles, transmission over distances greater than 35 feet is highly unlikely. Therefore, incoming horses should be placed in a stall, paddock, or pasture at least thirty to forty feet away from resident horses. Horses that were infected, or were on premise during an active case of EHV, should be contained on site for at least three weeks following the presentation of the last confirmed infection.

Equine herpes virus can remain infectious on inanimate objects such as feed tubs, water buckets, bridles, saddle pads, brushes, boots, blankets, bits, etc for three to four weeks. The virus can be sustained on the skin, hands, hair, clothes, shoes, etc., of caretakers for this three to four week period as well.

Disinfecting such objects and areas serves to inactivate or kill the virus. Dr. Crabbe, of Pacific Crest Sporthorse, located in Oregon, recommends the use of quaternary ammonium-based disinfectants (for example Cavicide), or phenolic-based disinfectants (for example Lysol). Such disinfectants have been found to be maximally effective in eradication of the virus. Special care should be taken to assure that contaminated materials having been in contact with infected horses not be used on infection-free animals so as to minimize the opportunity for the virus to spread.

By following basic preventative measures, such as isolation of incoming horses and disinfection of stalls, water buckets, and feed tubs, the instance of infection can be significantly minimized. Reducing horse-to-horse contact is another simple method to prevent the spread of the virus and contain the associated threat. For example, by disallowing horses to touch or rub noses, you have just retarded one of the main modes of EHV transmission: direct contact between horses. Monitoring the temperature of horses pre- and post-travel also serves as a good indication of EHV infection thereby facilitating rapid diagnosis.

Early detection, expedient quarantines, and strict adherence to hygienic practices are paramount. In the event of an outbreak, authorities versed in quarantine and biosecurity protocol should be contacted to aid in containment efforts. Personnel employed on the premises should also be trained in these areas so as to create the most sterile and secure environment possible. By containing the infected horses effectively, the virus can be isolated, an essential component in preventing epidemics.

W. David Wilson BVMS, MS of UC Davis Vet Medical center asserts that "…enforcement of strict biosecurity measures and hygiene practices are likely to be more effective than widespread vaccination in reducing the risk of acquiring infection." Therefore, containment and avoidance of cross-contamination is of utmost importance.

Conclusion:

Equine Herpes Virus is a prevalent disease among the horse population, both within the United States and world wide. While many are just now becoming acutely aware of the disease and its effects, it is not a new disease nor does it pose more of a threat now than it ever has in the past. In light of recent media attention and numerous press releases from states involved in the recent outbreak, fear is running high and worry is escalating accordingly.

Rest assured, there is no international EHV pandemic on the rise. A certain level of concern and paranoia is healthy and leads to appropriate hygienic and preventative measures, but excessive concern and paranoia is neither productive nor advantageous.

By now you are more informed in regards to the solid facts pertaining to EHV, having cut through the rumor and fear driven aspects. You are equipped to be as effective in recognizing the symptoms, minimizing the risk, preventing infection, and containing the spread of the virus. You possess this knowledge, and are now prepared to apply it to whatever setting may demand it.

Visual Summary:

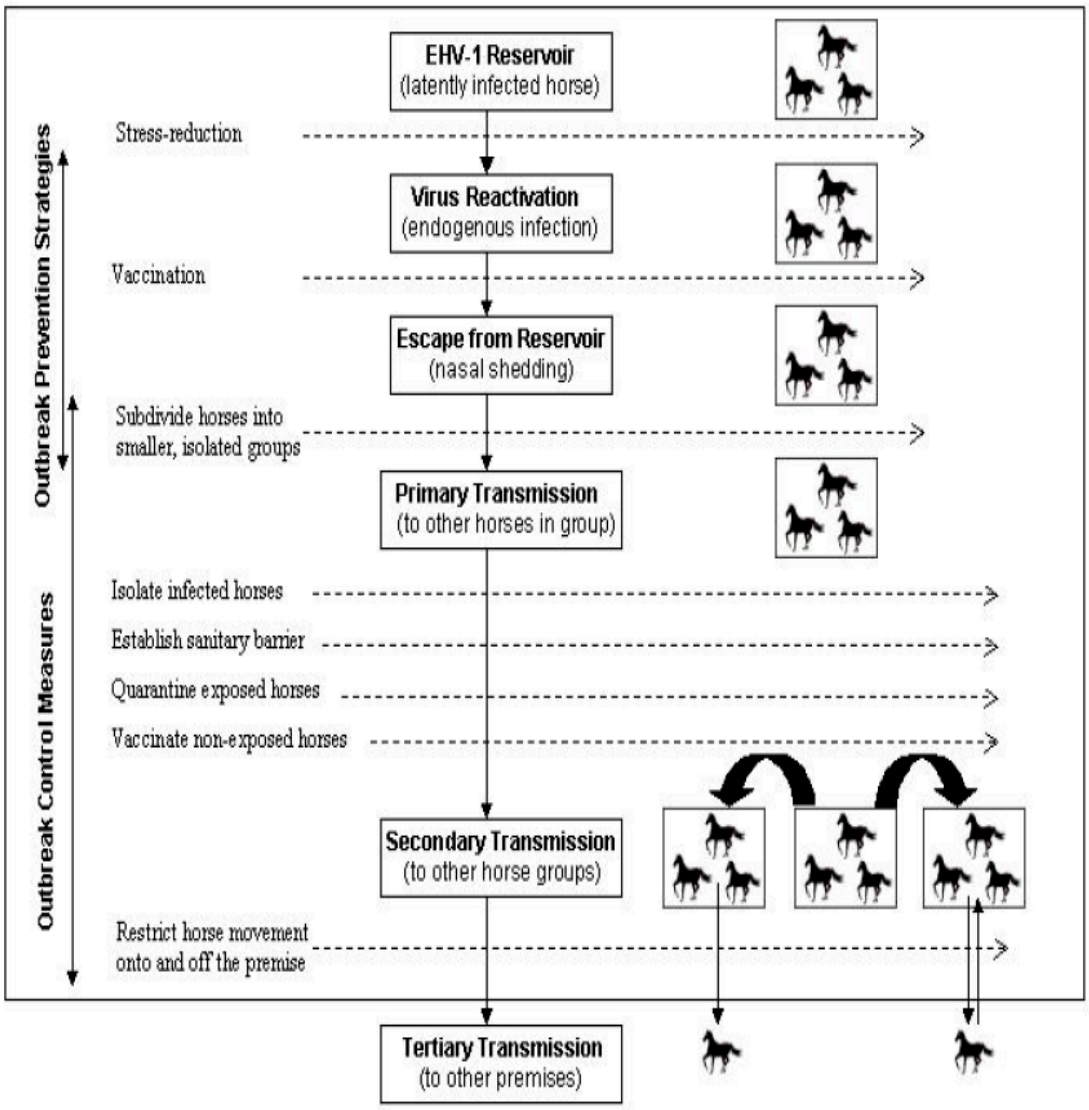


Figure 1. Diagrammatic illustration of the initiation and progression of a typical epidemic of EHV-1 infection (vertical arrows) and locations along the progression cycle at which specific control measures can be applied for interrupting transmission of the virus (horizontal arrows). L = latent virus; R = reactivated virus; S = shed virus; I = infecting virus.

http://www.ca.uky.edu/Gluck/images/faculty%20pages/Epidemic%20EHV-1%20disease.pdf