

Herpesviridae

(Bovine herpes virus, Equine herpes virus)

Dr. Savita Kumari

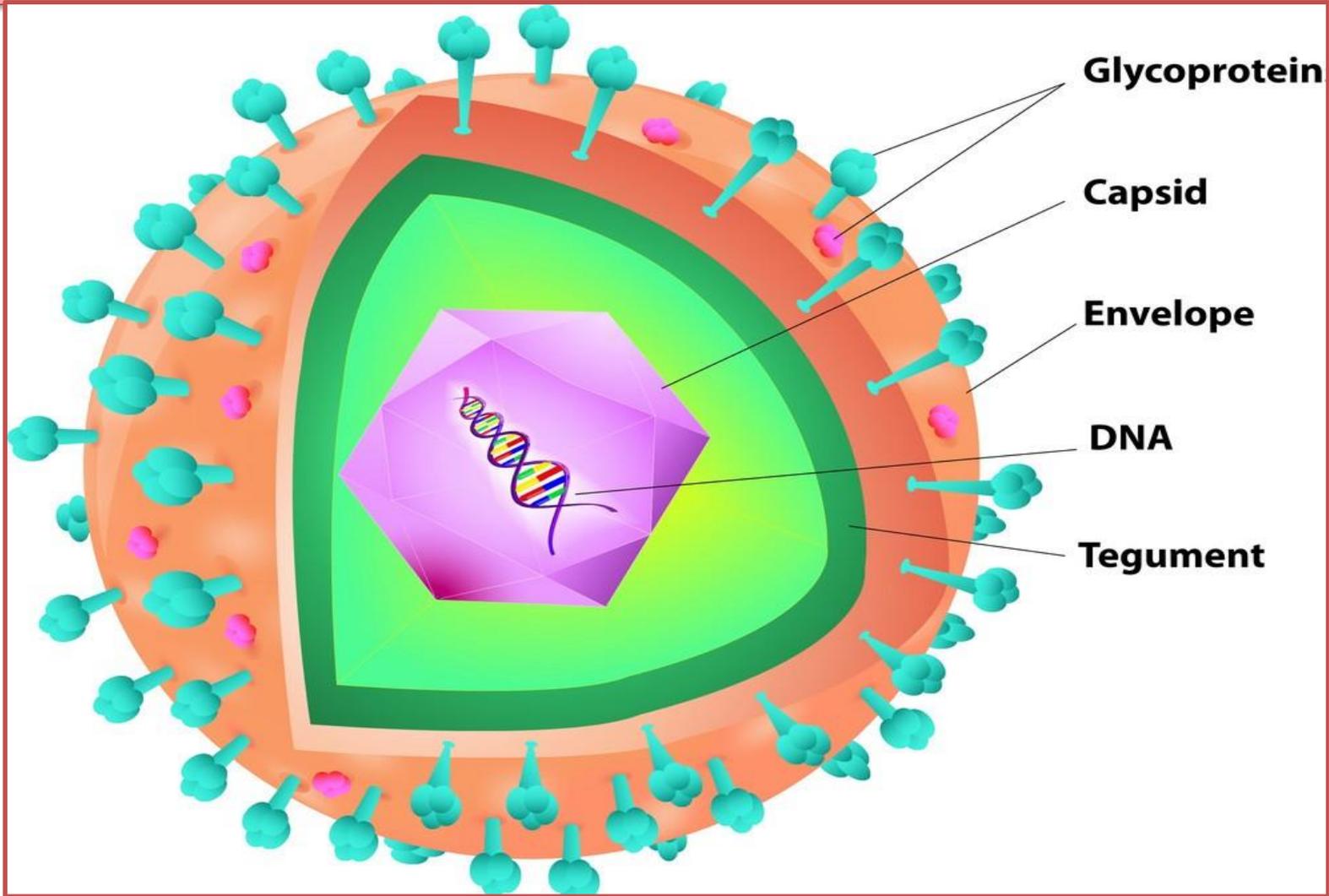
Department of Veterinary Microbiology

Bihar Veterinary College, BASU, Patna

Virion Properties

- The name, herpesvirus derived from Greek word *herpein*- to creep
- Herpesvirus virions are **enveloped**, containing an **icosahedral nucleocapsid**
- Herpes virions consist of - a DNA core, capsid, tegument, envelope
- **Core** consists of viral genome as a **single, linear dsDNA** molecule within the protein capsid
- Capsid composed of **162 capsomers** (150 hexons and 12 pentons)
- Surrounding the capsid is an amorphous coat of protein known as the **tegument**, it contains many viral proteins
- Tegument is enclosed by a typical **lipoprotein envelope** with numerous **glycoprotein spikes**

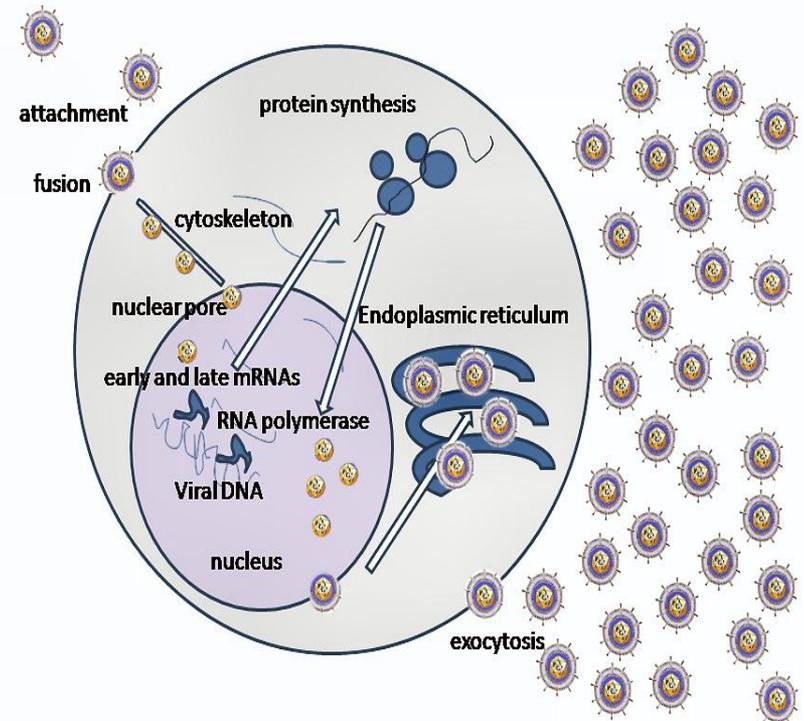
Structure of herpes virus



- Sensitive to ether and other lipid solvents
- Labile to heat, desiccation and acidic pH
- Can be cultivated in cell cultures derived from their natural hosts
- Alpha herpes viruses produce a rapid cytopathic effect characterized by syncytia formation and development of eosinophilic inclusion bodies in infected cells
- Beta and gamma herpes viruses slow cyto-pathogenic in cell culture
- Growth of some avian herpes viruses (ILT virus, duck plague virus) in embryonated eggs produce hemorrhages and pocks on CAM

Replication

- Virions attach to host cell with envelope glycoprotein
- Enter cells by fusing with plasma membrane
- Replication occurs in cell nucleus
- Envelope is derived from nuclear membrane of host cell
- Release occurs by exocytosis



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Alphaherpesviruses

- Replicate and spread rapidly, destroying host cells
- Often establish latent infections in sensory ganglia

Betaherpesviruses

- Replicate and spread slowly
- Cause infected cells to enlarge, also named as [cytomegaloviruses](#)
- May become latent in secretory glands and lymphoreticular cells

Gammapherpesviruses

- Infect T or B lymphocytes
- Can produce latent infections in these cells
- Some gammaherpesvirus species also replicate in epithelial and fibroblastic cells causing cytolysis
- A number of gammaherpesviruses are implicated in neoplastic transformation of lymphocytes

Herpesvirus Infections

- Infection results in characteristic eosinophilic intranuclear inclusion bodies
- Infection becomes latent, with reactivation and intermittent virus shedding
- Transmission is generally associated with direct mucosal contact, droplet and fomite infection
- Shedding of virus in nasal, oral, or genital secretions, skin (eg Marek's disease virus) provides the source of infection for other animals, including transfer from dam to offspring
- Moist, cool environmental conditions promote extended survival of herpesviruses

Classification

Family - 03 subfamilies

- *Alphaherpesvirinae-*

05 Genera- Simplexvirus, Varicellovirus, Mardivirus, Iltovirus, Scutavirus

- ❖ *Betaherpesvirinae-*

04 Genera: Cytomegalovirus, Muromegalovirus, Proboscivirus, Roseolovirus

- ❖ *Gammaherpesvirinae*

04 Genera: Lymphocryptovirus, Macavirus, Percavirus, Rhadinovirus

Subfamily *Alphaherpesvirinae*

- **Avian Alphaherpesviruses**

- **Anatid herpesvirus 1**

(Duck viral enteritis virus or duck plague virus)

- **Gallid herpesvirus 1**

(Avian infectious laryngotracheitis virus)

- **Gallid herpesvirus 2 (Marek's disease virus)**

- **Canid herpesvirus 1**

(Generalized hemorrhagic disease of puppies)

- **Caprine herpesvirus 1**

(conjunctivitis, disease of respiratory, digestive, and genital tracts, including abortion)

- **Felid herpesvirus 1 (Feline viral rhinotracheitis virus)**

(acute disease of the upper respiratory tract in cats)

Bovine Alphaherpesviruses

- Bovine herpesvirus 1
(Infectious bovine rhinotracheitis/Infectious pustular vulvovaginitis virus)
- Bovine herpesvirus 2 (Mammillitis/pseudolumpy skin disease virus)
- Bovine herpesvirus 5 (Bovine encephalitis virus)

Equine Alphaherpesviruses

- Equid herpesvirus 1 (Equine abortion virus)
- Equid herpesvirus 3 (Equine coital exanthema virus)
- Equid herpesvirus 4 (Equine rhinopneumonitis virus)

Suid herpesvirus 1

(Pseudorabies or Aujeszky's disease virus)

Subfamily *Betaherpesvirinae*

- Elephantid herpesviruses
(Endotheliotropic Elephant herpesvirus)
- Murid herpesviruses and Betaherpesviruses of lab. Animal
- Suid herpesvirus 2 (Porcine cytomegalovirus virus)

Subfamily *Gammaherpesvirinae*

- Malignant catarrhal fever virus
- Bovine herpesviruses 4,6
- Equid herpesviruses 2, 5, 7

Bovine herpes Viruses

- Herpesviruses can cause respiratory, genital, mammary and CNS diseases in bovine

Virus	Disease
Bovine herpesvirus 1	Respiratory (infectious bovine rhinotracheitis) and genital (infectious pustular vulvovaginitis, balanoposthitis) infections
Bovine herpesvirus 2	Ulcerative mammillitis (severe ulcerative condition of teats) Pseudolumpy-skin disease
Bovine herpesvirus 5	Encephalitis in calves
Bovine herpesvirus 4	Conjunctivitis, respiratory disease, vaginitis, mastitis, endometritis, skin nodules, lymphosarcoma
Bovine herpesvirus 6	Ubiquitous in healthy animal

Bovine herpesvirus 1 (Infectious bovine rhinotracheitis/ Infectious pustular vulvovaginitis virus)

- Associated with several conditions including- infectious bovine rhinotracheitis, infectious pustular vulvovaginitis, balanoposthitis, conjunctivitis and generalized disease in newborn calves
- Family *Herpesviridae*, subfamily *Alphaherpesvirinae*, genus *Simplex virus*
- Infection with BHV-1 of important cause of losses in livestock
- Single antigenic type of BHV-1 which contains subtypes 1.1, 1.2a and 1.2b
- Subtype 1.1 implicated in respiratory disease and is included in most vaccines
- Subtypes 1.2a and 1.2b cause mild respiratory disease, implicated in infectious balanoposthitis/infectious pustular vulvovaginitis (IBP/IPV) syndrome

Pathogenesis and pathology

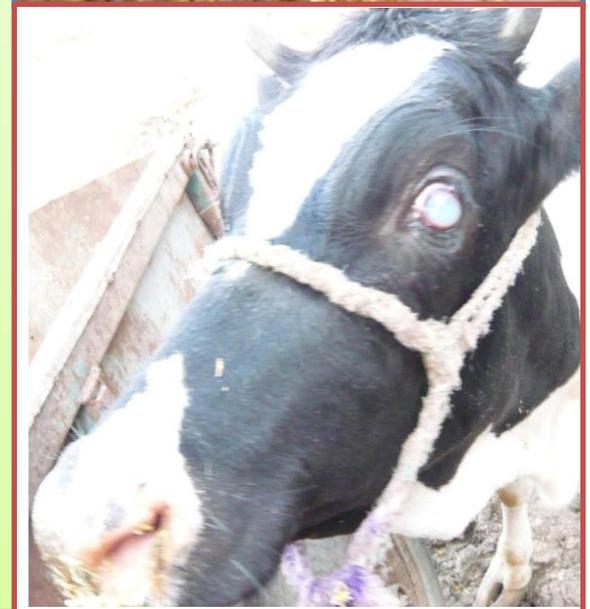
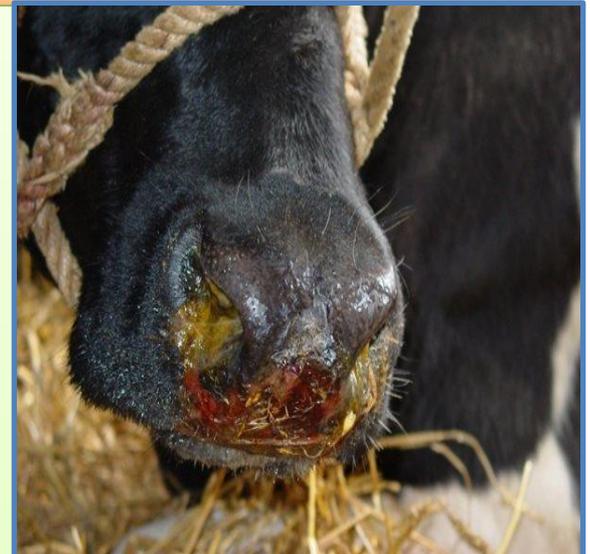
- The virus causing infectious bovine rhinotracheitis is usually acquired through aerosols
- Replication occurs in mucous membranes of upper respiratory tract
- Large amounts of virus are shed in nasal secretions
- Virus also enters local nerve cell endings and transported intraaxonally to the trigeminal ganglion where it remains latent
- Rarely, a lymphocyte-associated viraemia in pregnant cows may produce foetal infection and abortion

Pathogenesis and pathology

- Genital disease may result from coitus or artificial insemination with infective semen
- Virus replicates in the mucosa of the vagina or prepuce
- Latent infection may become established in sacral ganglia
- Focal necrotic lesions on genital mucosae may eventually coalesce to form large ulcers
- An intense inflammatory reaction can develop in the reproductive tract with secondary bacterial infection leading to endometritis
- Viraemia is not a feature of genital infection with BHV-1 subtypes and infected pregnant cows rarely abort

Clinical signs

- In outbreaks of disease, either respiratory or genital form usually predominates
- The incubation period is up to four days
- Severity of clinical signs in respiratory form of the disease increases with secondary bacterial infection
- Affected animals develop high temperature and nasal discharge accompanied by anorexia
- The nares are inflamed ('red nose'), conjunctivitis, lacrimal discharge and corneal opacity are often present
- In uncomplicated infections, animals recover after about a week



IBR

- If bacterial infection then animals develop dyspnoea, coughing and open-mouth breathing, death may occur
- In severe outbreaks in feedlot cattle, morbidity may approach 100% and mortality up to 10%
- Cows with infectious pustular vulvovaginitis exhibit vaginal discharge and frequent urination
- Animals usually recover within two weeks
- However, secondary bacterial infection may result in metritis, temporary infertility and purulent vaginal discharge persisting for several weeks
- Infected bulls have lesions on penile and preputial mucosae

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- Fatal generalized disease in young calves with fever, oculonasal discharge, respiratory distress, diarrhoea, incoordination and convulsions has been described
- Lifelong latent infection with periodic virus shedding occurs after bovine herpesvirus 1 infection
- In both forms of disease, the lesions are focal areas of epithelial cell necrosis
- Necrotic foci may be present in various organs of aborted foetuses, particularly in the liver

Diagnosis

- Swabs collected from the nares and genitalia of several affected animals during the early acute phase of the disease are suitable for virus isolation
- The virus produces a rapid cytopathic effect in bovine cell lines with syncytia and characteristic intranuclear inclusion bodies
- Demonstration of viral antigen using immunofluorescence using smears from nasal or genital swabs
- For aborted fetuses, histopathologic evaluation coupled with immunohistochemical staining
- PCR, Virus neutralization, ELISA
- As part of a surveillance programme, bulk milk samples can be tested for antibodies using ELISA

Control

- Control strategies are directed at management practices and vaccination
- Inactivated and modified live vaccines- for the control of BHV-1
- Vaccination reduces the severity of clinical signs but may not prevent infection
- Modified live vaccines may cause abortion and should not be administered to pregnant animals
- **Marker vaccines**, in which genes coding for thymidine kinase (associated with reduction of neurotropism, latency and reactivation of vaccine virus) and certain glycoprotein genes have been deleted, usually devoid of glycoprotein E (gE) against which a robust antibody response is mounted in response to natural infection
- As vaccinated cattle do not respond to that particular antigen, differentiation of infected from vaccinated animals (DIVA) is possible

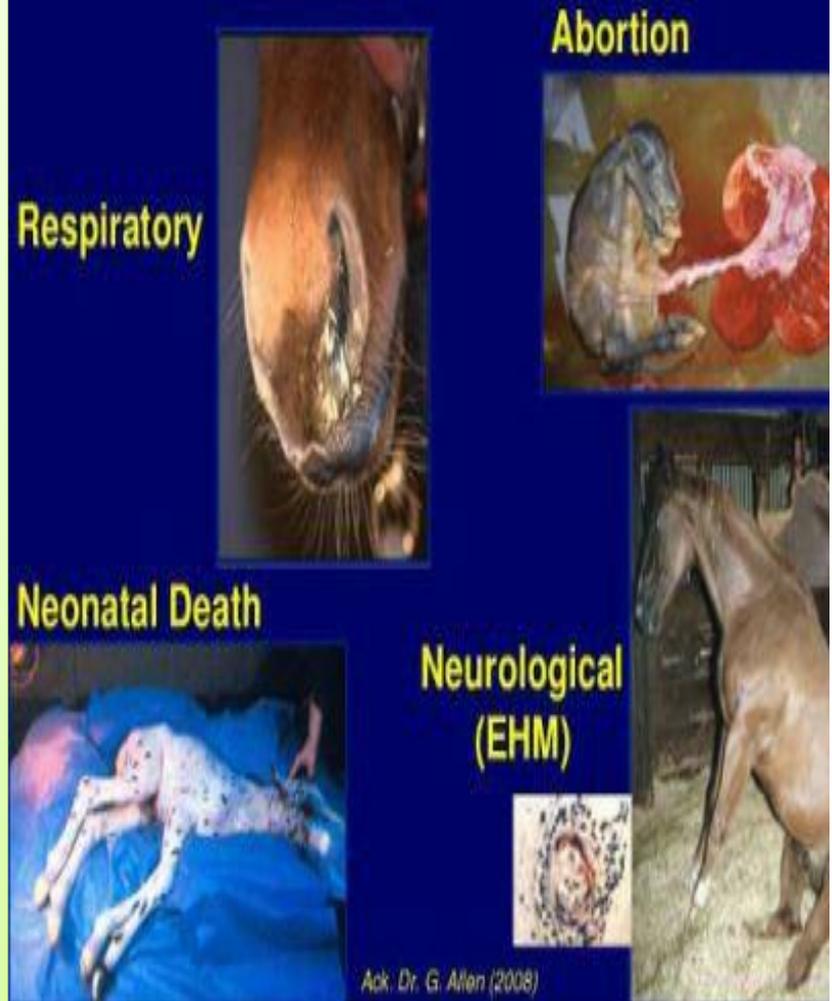
Herpesvirus infections of horses

Virus	Genus	Disease
Equine herpesvirus 1 (Equine abortion virus)	Varicellovirus	Causes abortion, respiratory disease, neonatal infection and neurological disease
Equine herpesvirus 3 (Equine coital exanthema Virus)	Varicellovirus	Causes mild venereal infection in both mares and stallions
Equine herpesvirus 4 (Equine rhinopneumonitis virus)	Varicellovirus	Causes rhinopneumonitis in young horses and sporadic abortion

Equid herpesvirus 1 (Equine abortion virus)

- Equid herpesvirus 1 - **most important viral cause of abortion** in horses (**equine herpesvirus abortion**)
- enzootic in horse populations worldwide
- also causes **respiratory disease** and **equine herpesvirus myeloencephalopathy (encephalomyelitis)**
- The principal route of infection- via the respiratory tract
- Viremia occurs after respiratory infection, sometimes leading to systemic infection and serious disease manifestations

Outcomes of EHV-1 Infection in Horses



Symptoms and lesions

- If large numbers of susceptible mares are exposed to the aborted conceptus, extensive outbreaks of abortion (**abortion storms**) occur
- Abortions may occur early in gestation, **majority occur in the last trimester of gestation**
- Fetuses aborted before 6 months of gestation may exhibit significant autolysis
- Aborted fetuses may exhibit icterus, meconium staining of the integument, excessive fluid (edema) in body cavities, distention of lungs, splenomegaly with prominent lymphoid follicles and numerous pale foci of necrosis on liver and kidney

Diagnosis

- Characteristic clinical presentation of abortion
- Gross and histologic lesions in aborted foals are highly suggestive of EHV-1, particularly the identification of intranuclear inclusion bodies within affected tissues
- Immunohistochemical staining
- PCR
- Virus isolation
- ELISA for detection of antibodies
- The preferred samples for virus detection are placenta, fetal lung, thymus, liver and spleen

Prevention and Control

- Through a combination of management practices and vaccination
- Mares are generally vaccinated regularly to reduce the frequency of abortion
- Inactivated and live-attenuated virus vaccines are commercially available and widely used
- Managements include- Isolation of pregnant mares in small groups based on their foaling dates, not introducing new mares into established groups, isolation of the index case (the first mare to abort) and all in-contact mares

Equid herpesvirus 3 (Equine coital exanthema virus)

- Causes- Equine coital exanthema (Genital Horsepox, Equine Venereal Balanitis), an acute, usually mild disease
- Lesions on external genitalia appear initially as red papules which develop into vesicles and pustules
- The pustules rupture leaving ulcers that may coalesce
- Lesions are occasionally present on the teats, lips and respiratory mucosa

Diagnosis

- Clinical diagnosis is based on the distribution and appearance of the lesions
- Electron microscopy of lesion scrapings or virus isolation in tissue culture to confirm infection
- Virus neutralization, ELISA

Control

- Affected horses should be isolated and should not be used for breeding until lesions have completely healed

Equid herpesvirus 4 (Equine rhinopneumonitis virus)

- Cause acute respiratory disease of horses, occurs most commonly in foals over 2 months old
- There is fever, anorexia, profuse serous nasal discharge that later becomes mucopurulent
- Live-attenuated and inactivated equine herpesvirus 1 vaccines, Combined vaccine including both equid herpesviruses 1 and 4 are available
- Live attenuated equid herpesvirus 1 vaccines also provide some protection against equid herpesvirus 4 infections

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THANKS