Herpesviridae

Marek's disease virus, Pseudorabies virus, Infectious laryngotracheitis virus, Bovine herpes viruses, Equine herpes viruses, Malignant catarrhal fever virus, Duck plague virus

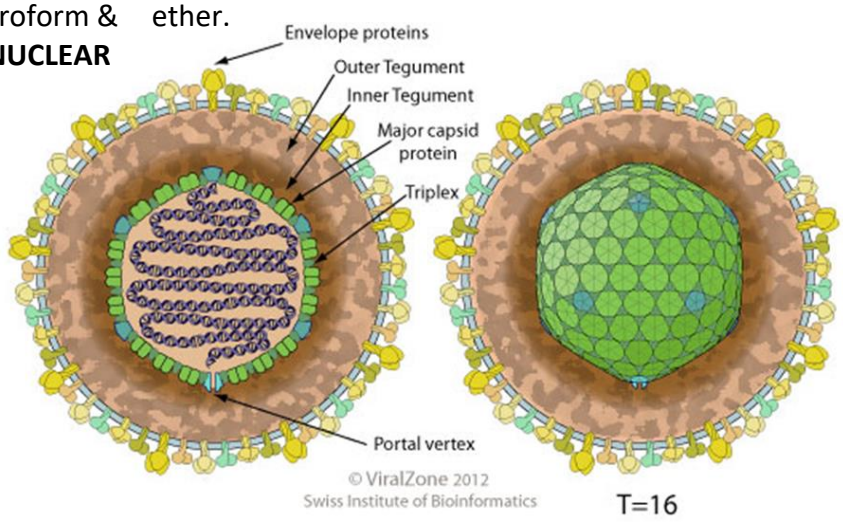
Latin 'Herpein' = To creep

Group I: dsDNA viruses

Order: ***Herpesvirales***
Family: ***Herpesviridae***
Subfamily: *Alphaherpesvirinae*
Genus: *Iltovirus*
Gallid alphaherpesvirus 1 **Infectious laryngotracheitis**
Mardivirus
Gallid alphaherpesvirus 2 ***Marek's Disease Virus***
Simplexvirus
Varicellovirus
Suid/porcine Herpesvirus 1 Pseudorabies virus
Subfamily: *Betaherpesvirinae*
Genus: *Roseolovirus*
Human betaherpesvirus 6A, 6B, 7
Subfamily: *Gammaherpesvirinae*
Genus: *Lymphocryptovirus*
Rhadinovirus
Macavirus ,
Percavirus

Properties of Herpesvirus

- Enveloped,
- spherical to pleomorphic,
- 150-200 nm in diameter,
- **Icosahedral symmetry**.
- Capsid consists of 162 capsomers and is surrounded by an amorphous tegument.
- Glycoproteins complexes are embed in the lipid envelope.
- Genome-complex consists of single linear molecule of double stranded DNA,**125-135 Kbp** in size.(Infectious under appropriate experimental conditions).
- Sensitive to chloroform & ether.
- **REPLICATION : NUCLEAR**



Bovine Herpes Virus

Bovine Herpes Virus Type 1 (BoHV-1) is a **highly contagious virus of cattle** and is known to be the causative agent of the Acute respiratory disease

Infectious bovine rhinotracheitis (IBR),
Infectious pustular vulvovaginitis
Infectious balanoposthitis.

Bovine herpesvirus 1 (BoHV-1) is an α-herpesvirinae subfamily member that causes significant economical losses to the cattle industry .
Three well-defined subtypes exist, BoHV-1.1, BoHV-1.2a, and BoHV-1.2b (2b).

Subtype 1 virus isolates are prevalent in Europe, North America, and South America: these subtypes are frequently detected in cattle suffering from **infectious bovine rhinotracheitis (IBR) and the respiratory tract of aborted fetuses**.

Subtype 2a strains are prevalent in Brazil and are associated with respiratory and genital tract infections, including IBR, infectious pustular vulvovaginitis (IPV), balanopostitis (IPV), and abortions.

Subtype 2b strains, which are frequently isolated in Australia or Europe, are associated with respiratory disease and IPV/IPB, but not abortion.

The seroprevelance of BoHV-1 ranges from 14 to 90% depending on the age of cattle and geographical location. Serological testing and removal of infected animals has eliminated BoHV-1 from Denmark, Switzerland, and Austria.

Replication of Herpes Virus

1. Following attachment via the binding of virion glycoprotein peplomers to host cell receptors
2. Enters nucleocapsid and Cytoplasm (Fusion of virion envelope to cell membrane)
3. Sequential transcription and translation of immediate early alpha, early beta and late gamma genes .
4. DNA enters the Nucleus and replicate and starts the host cell macromolecular synthesis
5. DNA replication and encapsidation takes place in the nucleus. Whereas the envelope is acquired by budding through the inner layer of the nuclear envelope.
6. Infection results in characteristic **eosinophillic intranuclear inclusion bodies.**

Pathogenesis

1. The **virus enters the animal via the nose** and replicates to high titres in mucous membranes of the upper respiratory tract and in the tonsils.
2. It subsequently disseminates to conjunctivae and by neuronal axonal transport reaches the trigeminal ganglion.
3. A low level viraemia can occasionally occur.
4. **After genital infection**, BHV1 replicates in mucous membranes of the vagina or prepuce, and becomes latent in sacral ganglia.

5. The viral DNA remains in the neurons of the ganglia probably for the entire life of the host.
6. Stress, such as transport and parturition, can induce reactivation of the latent infection.
7. Consequently, the virus may be shed intermittently into the environment.
8. The semen of an infected bull may contain BHV1 and the virus can thus be transmitted by natural mating and artificial insemination .

The disease is characterized by two forms :

1. Respiratory form: clinical signs of the upper respiratory tract, such as a (muco) purulent nasal discharge and by conjunctivitis. Secondary bacterial infections can lead to more severe respiratory disease.

2. Genital Form : The virus infects the genital tract and cause pustular vulvovaginitis and balanoposthitis.

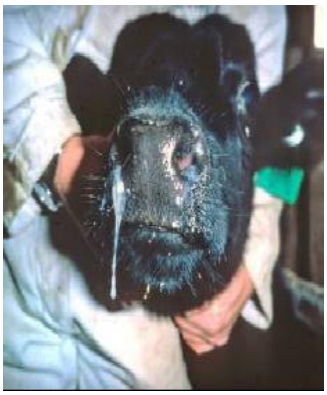
Clinical signs

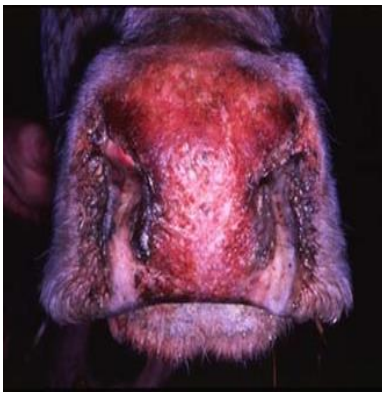
The most prominent clinical signs after an incubation period of 2-4 days,
Serous nasal discharge, salivation, fever, inappetance

- Within a few days the nasal and ocular discharges change to Mucopurulent.
- Necrotic lesions in the nose may progress to pustules and ulcers covered by a pseudomembrane that obstructs the upper airways and leads to mouth breathing.
- Infection may induce abortion and a reduction in milk yield.
- In calves infected with BHV1, a systemic disease may develop, with focal necrotic lesions in viscera and possibly a prominent gastroenteritis.

Many infections run a subclinical course.

- Secondary bacterial infections with, for example, Pasteurella spp., can give rise to more severe clinical signs due to the deeper airways being affected
- Where natural mating is practised, genital infection can lead to **pustular vulvovaginitis** or **balanoposthitis**, characterised by mild to severe necrotic lesions in **vaginal** or **preputial mucosae**.
  After artificial insemination with **infected semen**, endometritis can arise.

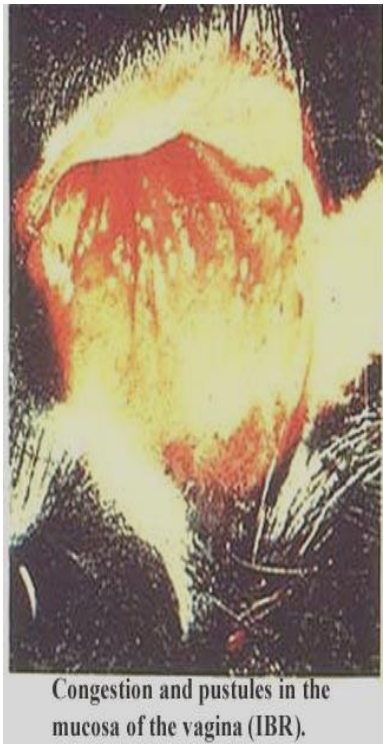




Red Nose

Bovine with corneal opacity

2 Ocular discharge (IBR).



Congestion and pustules in the mucosa of the vagina (IBR).

Immunity

Protective immunity after infection is not lifelong: cattle can be reinfected.

Maternal antibodies are transferred via colostrum to the young calf, which is consequently protected against BHV1-induced disease.

Maternal antibodies have a biological half-life of about 3 weeks, but may be detected occasionally in animals up to 6 months old, and rarely in animals over this age.

Diagnosis

1. Virus isolation : cell cultures of bovine origin are used, for example, secondary lung or kidney cells or the Madin Darby Bovine Kidney (MDBK) cell line. The virus produces a cytopathic effect in 2-4 days. It is identified by neutralisation or antigen detection methods using monospecific antisera or monoclonal antibodies. The BHV1 isolates can be further subtyped by DNA restriction enzyme analysis.

Collection of samples

Nasal swabs are collected from several (from five to ten) affected cattle in the early phase of the infection. These cattle still have serous rather than mucopurulent nasal discharge.

In case of vulvovaginitis or balanoposthitis, swabs are taken from the genitals.

The swabs should be vigorously rubbed against the mucosal surfaces.

The prepuce can also be washed with saline, and the washing fluid is then collected.

The specimens are suspended in transport medium (cell culture medium containing antibiotics and 2-10% fetal bovine serum to protect the virus from inactivation), cooled at 4°C, and rapidly submitted to the laboratory.

During necropsy, mucous membranes of the respiratory tract, and portions of the tonsil, lung, and bronchial lymph nodes, are collected for virus detection. In case of abortion, the fetal liver, lung, spleen, kidney and a placental cotyledon are examined.
Samples should be sent to the laboratory as quickly as possible, on ice.

2. Serological tests: The **virus neutralisation test** and various **enzyme-linked immunosorbent assays (ELISA)** are most widely used for antibody detection. Antibodies can be detected in milk with an ELISA.

3. Immunofluorescence

–Swab (early)

–Rapid, no amplification

4. PCR: For, various Viral DNA detection methods PCR been developed, and the polymerase chain reaction technique may prove to be particularly useful for testing semen samples

Control

1. Strict quarantine for new induction in the herd. Movement control : Ideally, a 2- 3-week quarantine period is imposed for newly introduced cattle. Only cattle that are BHV1-seronegative are then admitted to the herd.
2. Regular screening of breeding bulls for IBR (Serological/ Isolation of virus from Semen).
3. Slaughter of cattle with serologic evidence.
4. Vaccination is a common preventive measure.

Vaccines usually prevent the development of clinical signs and reduce the shedding of virus after infection. However, one disadvantage of the use of conventional vaccines is the inability to distinguish between antibodies induced by vaccination or infection. This interferes with programmes to eliminate the virus from farms, regions or countries, that are based on serology. By using gene-deleted or subunit vaccines that lack a specified (glyco)protein, this problem can be overcome - examples include the BHV1 gE-negative vaccines that are available currently in various countries. A companion diagnostic test is used that detects only antibodies to the deleted glycoprotein, and thus enables differentiation between vaccinated animals and those infected with wild-type virus (or vaccinated with conventional vaccines). These tools allow the identification of infected cattle in vaccinated populations, and improves the prospects for widescale eradication of BHV1.

Use of **Inactivated oil adjuvant vaccine** for cattle and buffalo against Infectious Bovine Rhinotracheitis (Vaccines have limitations-problem of masking latent infection.)
Commercial vaccine available:

Animal	Dosage	Age of Primary Vaccine	Booster Vaccination	Revaccination
Cattle	2 ml SC/IM	At any age (4-6) week in case of Calf)	11 to 12 weeks after primary vaccination	Annually (after primary vaccination)

Herpesviruses of Horses

Equine herpesviruses (EHVs) are a group of nine agents that cause diseases ranging in severity from a neurological disease, which can be fatal in more than 50% of infected animals (equid herpesvirus 1, EHV-1), to mild or subclinical infection of B-lymphocytes (equid herpesvirus 5, EHV-5).

Among the nine equid herpesviruses, three are referred to as asinine herpesviruses, which primarily infect donkeys. The six 'true' equid herpesviruses (EHV-1, EHV-2, EHV-3, EHV-4, EHV-5, and EHV-9) infect horses primarily and generally have a very narrow host range in vivo. However, EHV-9 is able to infect many different species and often causes lethal encephalitis in nonequine hosts.

EHVs represent two subfamilies, Alphaherpesvirinae and Gammaherpesvirinae, and two genera, Varicellovirus and Rhadinovirus, within the family Herpesviridae.

The most important EHVs clinically and economicaly are EHV-1 and EHV-4, whose genomes have been sequenced in their entirety. Mainly for these reasons, most research worldwide is focused on EHV-1, for which detailed studies on gene regulation, replication cycle in cultured cells, pathogenesis, and vaccine development have been conducted, while detailed knowledge on these functions in other EHVs is scarce.

Equine herpesvirus (EHV)

EHV is the single most important infectious cause of **equine abortion**. The disease is caused by **EHV-1** and, rarely, EHV-4. EHV-1 is also capable of causing **respiratory disease (most noticeable in foals and yearlings), paralysis, neonatal foal disease and uveitis/hypopyon**. EHV-4 normally causes respiratory disease but occasionally has caused abortion in single mares.

Uveitis is a form of eye inflammation. It affects the middle layer of tissue in the eye wall (uvea)

Hypopyon is a medical condition involving inflammatory cells in the anterior chamber of the eye.

*****