University of Mosul
Lecture No.:
College of Veterinary Medicine
Date:
Unit of Scientific Affairs
Website:

Lecture title: Herpesviridae

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Summary: Herpesviridae

Herpesviruses have been found in insects, reptiles, amphibians and mollusks as well as in virtually every species of bird and mammal that has been investigated.

At least one major disease of each domestic animal species, including such important diseases as infectious bovine rhinotracheitis pseudorabies, and Marek's disease.

• About 100 herpesviruses have been at least partially characterized and the genomes of at least 19, including equine herpesviruses and 4 bovine herpesvirus 1 alcelaphine herpesvirus 2 and 1 and channel catfish herpesvirus

Classification

• The family Herpesviridae is divided into four subfamilies Alphaherpesvirinae, Betaherpesvirinae, Gammaherpesvirinae and an unnamed subfamily comprising the channel catfish herpesvirus-like viruses.

• This division was originally based on biological properties, but in general it has accorded well with subsequent molecular

characterizations including nucleotide sequence and phylogenetic analyses

- The subfamilies have been divided into genera, but at this level classification is incomplete and large numbers of viruses, including many important animal pathogens, have been classified only to the subfamily level or have been left unclassified

Subfamily Alphaherpesvirinae

- The prototypic viruses of the genera of this subfamily are human herpesvirus 1 (herpes simplex virus genus Simplexvirus) and human herpesvirus 3 (varicella-zoster virus; genus Varicellovirus).
- Gallid herpesvirus 1 (infectious laryngotracheitis virus) and Marek's disease virus are the prototypes of two new, as yet unnamed, genera in this subfamily; although having a genomic organization

similar to that of the mammalian viruses of the subfamily, these viruses exhibit significant differences in their biological properties

Subfamily Betaherpesvirinae

- This subfamily comprises the cytomegaloviruses of many species; the prototype of the subfamily is human herpesvirus human cytomegalovirus
- Subfamily Gammaherpesvirinae
- This subfamily comprises the herpesviruses that are lymphotropic; the prototype is human herpesvirus 4

Virion Properties

- Herpesvirus virions are enveloped, about 150 nm in diameter and contain an icosahedral nucleocapsid about 100 nm in diameter composed of 162 hollow capsomersml50 hexamers and 12 pentamers
- The DNA genome is wrapped around a fibrous spool like core Surrounding the capsid is a layer of globular material, known as the tegument, which is enclosed by a typical lipoprotein envelope with numerous small glycoprotein peplomers. Because of the variable size of the envelope, virions can range in diameter from 120 to 200 nm.
- The genome consists of a single linear molecule of double-stranded DNA, 125- 235 kbp in size, which is infectious under appropriate experimental conditions

Viral Replication

- Following attachment via the binding of virion glycoprotein peplomers to host cell receptors, , the nucleocapsid enters the cytoplasm either by fusion of the virion envelope to the cell membrane or by endophagocytosis.

- The DNA-protein complex is then freed from the nucleocapsid and enters the nucleus, quickly shutting off host cell macromolecular synthesis
- Maturation involves the completion of encapsidation of virion DNA

into nucleocapsids and the association of nucleocapsids with altered patches of the inner layer of the nuclear envelope, followed by envelopment by budding Mature virions accumulate within vacuoles in the cytoplasm and are released by exocytosis or cytolysis.

• Virus-specific proteins are also found in the plasma membrane, where they are involved in cell fusion, may act as Fc receptors, and are presumed to be targets for immune cytolysis

Infectious Bovine Rhinotracheitis

(Caused by Bovine Herpesvirus 1)

• Bovine herpesvirus 1 (infectious bovine rhinotracheitis virus;

• infectious pustular vulvovaginitis virus) causes a variety of diseases in cattle, including rhinotracheitis pustular vaginitis, balanoposthitis, conjunctivitis, abortion, enteritis, a generalized disease of newborn calves and possibly encephalitis

Pathogenesis

• Genital disease may result from coitus or artificial insemination although some outbreaks, particularly in dairy cows, may occur in the absence of coitus.

• Respiratory disease and conjunctivitis result from droplet transmission. Within the animal, dissemination of the virus from the initial focus of infection probably occurs via a cell associated viremia Lifelong latent infection with periodic virus shedding occurs after bovine herpesvirus 1 infection; the sciatic and trigeminal ganglia are the sites of latency following genital and respiratory disease, respectively.

• The administration of corticosteroids results in reactivation of the virus and has been used as a means of detecting and eliminating carrier bulls in artificial insemination centers.

• Infectious Bovine Rhinotracheitis (Caused by Bovine Herpesvirus 1)

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• Clinical Features

Genital Disease Infectious pustular

vulvovaginitis is recognized most commonly in dairy cows. Affected cows develop fever, depression, anorexia, and stand apart, often with the tail held away from contact with the vulva; micturition is frequent and painful

- The vulval labia are swollen, there is a slight vulval discharge, and the vestibular mucosa is reddened with many small pustules Adjacent pustules usually coalesce to form a fibrinous pseudomembrane that covers an ulcerated mucosa.
- The acute stage of the disease lasts 4-5 days and uncomplicated lesions usually heal by 10 to 14 days. Many cases are subclinical or go unnoticed. Lesions of infectious balanoposthitis in bulls and the clinical course of disease are similar Where lesions are extensive and acute there is reluctance or complete refusal to serve. Semen from recovered bulls may be contaminated with virus as a result of periodic shedding.
- However, cows may conceive to the service or artificial insemination from which they acquire infectious pustular vulvovaginitis, and pregnant cows that develop the infection rarely abort.
- Respiratory Disease Infectious bovine rhinotracheitis occurs as a subclinical, mild, or severe disease. Morbidity approaches 100% and mortality may reach 10%, particularly if complications occur.

Initial signs include fever, depression, inappetence, and a profuse nasal discharge, initially serous and later mucopurulent.

• The nasal mucosa is hyperemic and lesions within the nasal cavity, which may be difficult to see, progress from focal pustular necrosis to large areas of shallow, hemorrhagic, ulcerated mucosa covered by a cream-colored diphtheritic membrane.

• The breath may be fetid. Dyspnea, mouth breathing, salivation, and a deep bronchial cough are common. Acute, uncomplicated cases last 5-10 days. Unilateral or bilateral conjunctivitis, often with profuse lacrimation, is a common clinical sign in cattle with infectious bovine rhinotracheitis but may occur in a herd as an almost exclusive clinical sign.

• Gastroenteritis may occur in adult cattle and is a prominent finding in the generalized disease of neonatal calves, which is often fatal. Abortion may occur at 4-7 months gestation, and the virus has also been reported to be cause mastitis.

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