

# *Picornaviridae*

VMC 321

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# ETYMOLOGY

- *Picornaviridae*
  - ‘Pico’ - very small
  - ‘rna’ - RNA
  - *viridae* - suffix used for family of virus
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- The *Picornaviridae* family includes small, icosahedral viruses with single-stranded, highly diverse positive-sense RNA genomes.

# Taxonomy

## Group IV : (+) sense, ss RNA viruses

### Order: Picornavirales

Family	Genus	Species	Host
Picornaviridae	Aphthovirus	Foot-and-mouth disease virus	cloven footed animal
	Avihepatovirus	Duck hepatitis A virus	Duck
	Erbovirus	Equine rhinitis B virus	Equine
	Hepatovirus	Hepatitis A virus	Vertebrates
	Sapelovirus	Porcine sapelovirus	Pig
	Teschovirus	Porcine teschovirus	Pig

# Characteristics of members of the family *Picornaviridae*

Characteristic	Description
Prototype	poliovirus 1 , species Enterovirus C, genus Enterovirus
Virion	Non-enveloped, 30–32 nm virions comprising 60 protomers
Genome	6.7–10.1 kb of positive-sense, non-segmented RNA with a poly(A) tail
Replication	RNA synthesis occurs in reorganized cytoplasmic replication organelles containing non-structural proteins derived from the 2BC-P3 region of the encoded polyprotein; RNA structures at the 5' and 3' ends of the genome direct initiation of RNA synthesis and uridylated 3B serves as primer for synthesis of both RNA strands
Translation	Directly from genomic RNA containing an internal ribosomal entry site (IRES)
Host range	Vertebrates (at least five of the seven classes)

# Virion Morphology

- Virions consist of a capsid, with no envelope, surrounding a core of ssRNA.
- Virus particles size: 30–32 nm in diameter
- Shape— Isometric; non-enveloped
- Symmetry — Icosahedral
- Genome— linear; 7.2- 8.4 kb; single segment; positive sense; single stranded RNA
- Molecular weight—  $2.5 \times 10^6$  k Da
- Virus has four major protein ( $VP_1$ ,  $VP_2$ ,  $VP_3$ , &  $VP_4$ ) & one minor protein( $VP_0$ )

# Replication

- i. virion attaches to receptor , penetrates the host cell
- ii. uncoating occurs & VP<sub>0</sub> is removed from RNA segment by cellular enzyme
- iii. FMDV use entire RNA as mRNA, whole genome is translated & cleaves into different functional protein.

# The Disease

- Foot and Mouth Disease (FMD)

# Susceptible host:

- Cattle
- Buffalo
- Sheep
- Goat
- Deer
- Pig
- Camel
- Mithun
- Yak



# **Reservoir/Carrier:**

- Wild ruminants
- **Cattle- indicator host**
- **Sheep- maintenance host**
- **Pig- amplifying host**

# Transmission:

- spread at rapid rate through:
  - contact with infected animal
  - contaminated feed, Utensil
  - aerosol
  - ingestion

# Pathogenicity:

- RNA itself is infectious
- Virus invades epithelium of upper respiratory tract or alimentary tract by via inhalation or ingestion and multiplies at the site of infection
- Formation of vesicle within 1-4 days
- Primary vesicle initiates viraemia and associated with fever
- Dissemination through viraemia and lodgment in distant epithelia & formation of secondary vesicle
- Stratified squamous epithelium are the predilection site of FMDV and vesicles are found in these tissues or mucous membrane.

# Clinical sign:

- Appearance of vesicles on mucous membrane of tongue , lips, gums, cheeks, dental pad & skin of interdigital space, teats and udder
- Profuse salivation , drooling of foamy& ropy saliva and protrusion of tongue
- Pregnant animals abort
- Suckling calves die as a result of myocardial degeneration (tigeroid heart)

# Diagnosis:

- 1. Clinical signs and symptoms
- 2. Isolation and identification of virus
  - Specimen for virus isolation: vesicular fluid, epithelial tissues from ruptured vesicle & transported in glycerol buffer
- 3. Demonstration of viral antigen in clinical specimen
  - Virus neutralization test (VNT)
  - Immunofluorescence test (IFT)
  - Complement fixation test (CFT) and
  - Enzyme linked immunosorbent assay (ELISA)

- 4. Demonstration of antibody in convalescent sera
  - Liquid phase block - Enzyme linked immunosorbent assay(LPB-ELISA)
  - Complement fixation test (CFT)
- 5. Detection of viral nucleic acid
  - *In situ* hybridization(with labeled gene probes)
  - Reverse transcriptase –polymerase chain reaction(RT-PCR)

# Precaution:

Vaccination	Age
Initial	4 months & above
Booster	1 months of first vaccination
Revaccination	Every six months

1. Vaccination

Trivalent FMD vaccine containing O, A, , Asia-1

Dose- 2ml (Cattle & buffalo) ; 1 ml (Sheep & Goat)

2. Disease awareness, early detection, proper disposal of affected carcass, timely notification,

3. Strict biosecurity, isolation, zoning, quarantine, control of animal movement are prerequisites for effective control programmes aimed at eradication

# Duck hepatitis virus (DHV)

- Three types of viruses are recognized:
- Type 1
- Type 2
- Type 3
- All the above three types causes hepatitis in duck,however, type1 is prevalent in India



# The Disease

- **DHV causes duck virus hepatitis**
- **Duck virus hepatitis** :- Duck hepatitis is a highly fatal , rapidly spreading viral infection of young ducklings characterized primarily by hepatitis.
- **Susceptible host:** Ducklings
- **Reservoir:** Wild birds, recovered ducks and rats
- **Transmission:** Contact with infected bird
- **Incubation period:** 18-24hrs.

# Pathogenicity:

- I. Duckling of 3-4 weeks old are infected ;disease takes rapid cours
  - II. Virus invades epithelium of upper respiratory tract by inhalation  
multiplies at the site of infection
- Mortality is as high as 100% ; morbidity may be up to 95%

# **Clinical sign:**

- I. The duckling reluctance to move & squat down
- II. Birds fall down on their sides; starts kicking their legs spasmodically and death ensues with head bent backward
- III. Death occurs within an hour

# Diagnosis:

1. Clinical signs and symptoms

2. Post – mortem lesions :-

- ✓ Hepatomegaly with punctuate & ecchymotic haemorrhages ;
- ✓ Mottling & discolouration of liver ;
- ✓ Splenomegaly & its mottling ;
- ✓ In few cases swelling of kidney & congestion of blood vessel is observed.

- **2. Isolation and identification of virus**

- Specimen for virus isolation: Liver of infected bird

- Suspected sample is inoculated into SPF/antibody free **embryonated duck egg** (10-14day old) or **chicken egg** (9-11 day old) via **allantoic sac** ; infected duck embryo dies within 24-72 hrs. ; Chicken embryo dies within 5-8 days. The gross lesion of embryo shows stunting & sub cutaneous haemorrhages of body, oedema of abdomen & hind limb. Swollen ,reddened & yellowish discoloration of liver
- Primary cell culture of duck embryo liver cells.
  - CPE – includes rounding & necrosis of cells,

- 3. Demonstration of viral antigen in clinical specimen
  - Virus neutralization test (VNT)
  - **Immunofluorescence test (IFT)** –rapid & accurate diagnostic method
  - Enzyme linked immunosorbent assay(ELISA)
  
- 4. Demonstration of antibody in convalescent sera
  - Virus neutralization test (VNT)
  - Enzyme linked immunosorbent assay(ELISA)

Thanks