Parvoviridae

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Introduction

- Name derived from latin word “Parvus”- means “small”

- Paroviruses are causative agents of several important animal diseases

- 2 subfamilies-
  - Parovirinae - viruses of vertebrates, 8 genera
  - Densovirinae- viruses of insects/other invertebrates
Characteristics

- Small DNA virus, Genome-SS, linear, positive-sense or negative-sense

- Icosahedral symmetry and composed of 60 protein subunits

- Non-enveloped

- Resistant to: lipid solvents, pH 3 to 9, heating at 56°C for > 60 min.

- inactivated by formalin, β-propiolactone, sodium hypochlorite

- Remain viable in fomites for long time

- Site of replication of virus- Nucleus
Characteristics:

- Infection leads to large intranuclear inclusion bodies

- have haemagglutinating activity (except Aleutian mink disease virus and goose parvovirus) and used for identification.

- majority of pathogenic animal parvoviruses are included in the genus *Protoparvovirus*

- Shed in large numbers in faeces
• require mitotically active cells to replicate their DNA

• some parvoviruses show tropism for rapidly dividing cells
  (hemopoietic precursors, lymphocytes, progenitor cells of intestinal mucosal lining)

• mitotically active cells in specific tissues in early life confers age-dependent susceptibility to several parvovirus diseases.
Subfamily Parvovirinae

08 genera:

<table>
<thead>
<tr>
<th>1. Amdoparvovirus</th>
<th>5. Dependoparvovirus</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Bocaparvovirus</td>
<td>7. Protoparvovirus</td>
</tr>
<tr>
<td>4. Copiparvovirus</td>
<td>8. Tetraparvovirus</td>
</tr>
</tbody>
</table>

- *Dependoparvovirus* also includes adeno-associated viruses of mammals that need the presence of a helper virus for their efficient replication.
<table>
<thead>
<tr>
<th>Genus</th>
<th>Virus</th>
</tr>
</thead>
</table>
| **Protoparvovirus**       | Feline panleukopenia virus  
Mink enteritis virus  
Canine parvovirus 2  
Porcine parvovirus  
Parvoviruses of rodents  
Rabbit (lapine) parvovirus |
| **Amdoparvovirus**         | Aleutian mink disease virus                                      |
| **Aveparvovirus**          | chicken and turkey paroviruses                                    |
| **Bocaparvovirus**         | Bovine parvovirus  
*Canine minute virus* (canine parvovirus 1)/ canine bocavirus  |
| **Dependoparvovirus**      | Goose parvovirus  
Duck parvovirus                                                       |
# Parvoviruses of veterinary significance

<table>
<thead>
<tr>
<th>Virus</th>
<th>Host</th>
<th>Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bovine Parvovirus</td>
<td>Bovine</td>
<td>Diarrhea in calves</td>
</tr>
<tr>
<td>Canine parvovirus 1 (Minute canine virus)</td>
<td>Dogs</td>
<td>subclinical enteric infection</td>
</tr>
<tr>
<td>Mink enteritis virus</td>
<td>Mink</td>
<td>Generalized disease analogous to feline panleukopenia</td>
</tr>
<tr>
<td>Goose parvovirus (goose plague virus)</td>
<td>Geese</td>
<td>Highly contagious, fatal disease of goslings (Derzsy's disease): hepatitis, myositis, including myocarditis</td>
</tr>
<tr>
<td>Aleutian mink disease virus</td>
<td>Mink, ferrets</td>
<td>Chronic, progressive disease, Persistent viraemia, immune complex-related lesions</td>
</tr>
<tr>
<td>Porcine parvovirus</td>
<td>Pigs</td>
<td>stillbirths, mummification, embryonic deaths and infertility (SMEDI syndrome)</td>
</tr>
<tr>
<td>Feline panleukopena virus</td>
<td>Domestic and wild cats</td>
<td>systemic &amp; enteric disease (Panleukopenia, enteritis)</td>
</tr>
<tr>
<td>Canine parvovirus 2</td>
<td>Dogs</td>
<td>Panleukopenia-enteritis syndrome, myocarditis in pups (now rare)</td>
</tr>
</tbody>
</table>
Feline panleukopenia

- also known as
  - feline infectious enteritis
  - feline distemper

- predominantly in young recently-weaned kittens

- Fleas and humans may act as mechanical vectors.

- Infection through ingestion or inhalation
Pathogenesis

• replication occurs in lymphoid tissues of oropharynx and associated lymph nodes.

• destruction of cells of intestinal crypts and lymphopoietic cells of bone marrow, thymus, lymph nodes and spleen.

• results in panleukopenia and villous atrophy.
Clinical signs

- I.P. - 4-5 days.
- Subclinical infection-
  - common, mild fever and leukopenia
  - usually followed by life-long immunity

Subacute disease-

- depression, fever and diarrhoea for 1-3 days
- followed by rapid recovery.
Severe disease-
• in unvaccinated kittens (6-24 wks of age)

• pronounced depression, anorexia, fever, vomiting, sometimes accompanied by diarrhoea or dysentery

• severe dehydration and electrolyte imbalance, abdominal pain

• Subnormal temp. followed by death within 24 hrs.

• mortality rate- 25 to 90% , Immunity long-lasting.
Infections early in gestation

- may result in resorption or abortion.

Infections during late pregnancy

- Stillbirths, early neonatal death
- teratological changes (cerebellar hypoplasia and retinal dysplasia) in litters
- Kittens with cerebellar hypoplasia exhibit cerebellar ataxia (incoordination, tremors)
- symptoms persist for life.
Diagnosis

- History of unvaccinated cats with diarrhoea
- Low WBC count
- Demonstration of virus in faecal samples by EM
- Detection of Viral antigen in faeces using ELISA
- Haemagglutination inhibition (HAI) by employing pig or Rhesus monkey red cells
- Virus neutralization test
- PCR
Treatment & Control

- Intensive supportive therapy - fluid therapy
- Whole blood or plasma from immune donors
- broad-spectrum antibiotics for secondary bacterial infections
- optimal diet supplemented with B complex vit.
- Modified live and inactivated vaccines
- thorough disinfection of premises with 1% sodium hypochlorite or 2% formalin
Canine parvovirus infection

- Canine parvovirus serotype 2 primarily involved

- acute enteric disease in young dogs between weaning and 6 months of age.

- considered as host-range mutant of feline panleukopenia virus

- Transmission predominantly by the faecal-oral route

- form and severity of disease depends on age and immune status of the animal
Pathogenesis

- Virus replicates initially in pharyngeal lymphoid tissues and Peyer's patches, viraemia develops.

- rapidly multiplying cell populations are main target tissues.

- During the first two wks of life- active cardiac myocyte division allowing viral replication - results in necrosis and myocarditis.

- In older pups, virus invades the actively dividing epithelial cells of the crypts in the small intestine.
• blunting of villi- reduced absorptive and digestive capacity leading to diarrhoea.

• extensive haemorrhage of intestinal lumen in severely affected pups.

• Destruction of lymphoid tissues of intestinal mucosa and mesenteric LN ----immunosuppression

• Secondary Gram-negative bacteria invasion of damaged intestinal tissues--- Endotoxaemia, endotoxic shock
Clinical signs

Enteric form

- Incubation period- 4-7 days
- Sudden onset of vomiting and anorexia.
- Depression and fever may be observed.
- Diarrhoea, often blood-stained within 48 hrs, in severe cases, frank haemorrhage.
- Faeces with foetid smell, dehydration and weight loss.
- Severely affected animals die within three days.
- Survived animals – long lasting immunity.
**Myocardial form (Now rare)**

- results from infection in the first week of life

- Parvovirus infection of myocardium can occur due to rapid proliferation of myocytes in first week after birth

- usually manifested as acute heart failure and sudden death in pups

- Pups surviving acute myocardial injury may subsequently develop cardiomyopathy

- now rare due to widespread immunity in breeding bitches that protects most puppies during the susceptible period.
Diagnosis

- Sudden onset of foul-smelling, bloody diarrhea in young dogs is suggestive

- Hemagglutination of pig, cat, or rhesus monkey red blood cells by virus present in fecal extracts

- Immunocytochemical staining- For viral Ag in tissue sections

- Presence of basophilic intranuclear inclusions in cardiac myocytes is confirmatory

- Electron microscopy, ELISA , PCR

- Virus isolation- canine & feline cell lines e.g. canine A72 cells, Crandell feline kidney cell line (CRFK)
Treatment

• No specific treatment is available

• Intensive supportive therapy (anti-emetics and fluid administration)

• Broad-spectrum antibiotics for secondary bacterial infections.

• Dogs with sub acute or chronic heart failure- rest and diuretic therapy
Prevention & Control

• Immunity after natural infection appears to be lifelong.
• Inactivated vaccines - safe to use in pregnant bitches.
• Modified live vaccines- vaccination of pups
• Thorough disinfection of premises with 1% sodium hypochlorite and 2% formalin