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# Canine Parvovirus Infections

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- Contagious, virulent, inoculable disease caused by variants of canine parvovirus type 2 (CPV-2 = Canine parvovirus type 2).
- Systemic infection = Primarily gastrointestinal + immunological effects.
- Clinically characterized = Hemorrhagic gastroenteritis: Anorexia, vomiting, bloody and watery diarrhea, sepsis following severe neutropenia.
- **Common in young dogs. (aged 6 to 16 weeks).**
- **The most concerning of canine infectious diseases.**

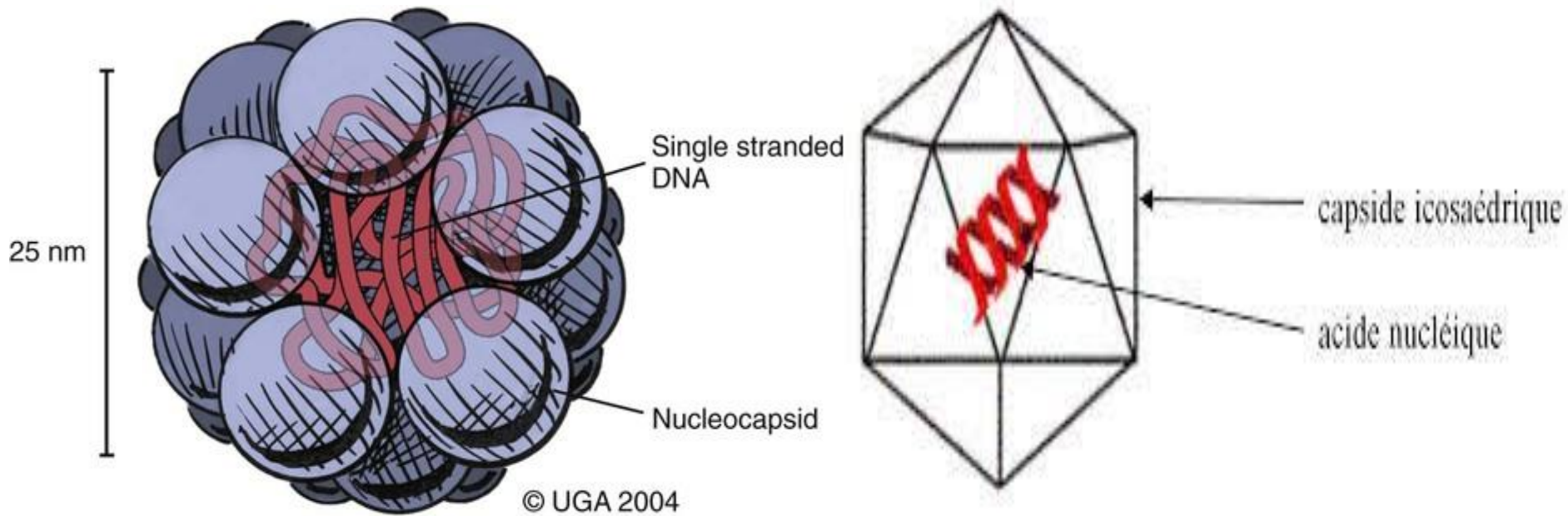
➤ Canine parvovirus = Described for the first time in the late 1970s, almost simultaneously in Europe, North America, and Australia =

During the global spread of the disease =

Panzootic

# **Etiology**

- Canine parvovirus belongs to:
  - Family of Parvoviridae.
  - Subfamily of Parvovirinae.
  - Genus Parvovirus.
- Small, non-enveloped, single-stranded DNA virus.
- Icosahedral capsid.
- Variants of CPV-2: CPV-2, CPV-2a, CPV-2b, CPV-2c.



<b>Virus</b>	<b>Animaux</b>	<b>Distribution</b>	<b>Symptômes</b>
Virus de la panleucopénie féline (FPV)	Chat	Mondiale	Entérite, état typhique, hypoplasie du cervelet, leucopénie
Parvovirus canin de type 1 (CPV1 = canine minute virus)	Chien	Mondiale (presque disparu)	Avortements, troubles de la fertilité
Parvovirus canin de type 2 (CPV2)	<b>Chien</b>	Mondiale	<b>Gastro-entérite, leucopénie, myocardite</b>

➤ CPV-2 = Canid-specific.

➤ CPV-2 is differentiated from feline parvovirus (panleukopenia virus) only by a few DNA base sequences, but it is pathogenic only for canids.

# Resistance to the environment

➤ CPV-2 = Very high resistance in the external environment =

Resists:

- 30 min at a temperature of 70°C.
- At a pH range = 3-11; Stomach: pH < 3.
- On: Clothing, surfaces and utensils for +5 months.
- Environment = Long periods (> 1 year).
- Ambient temperature = Remains infectious for at least 6 months in feces.
- Has many disinfectants and detergents.

## ➤ Sensitive

- Sodium hydroxide 2%, peracetic acid 0.2%, glutaraldehyde 0.2% (toxic to animals), UV destroys them.
- **Sodium hypochlorite (Bleach 1/30) = Effective disinfectant with prolonged contact time (with surfaces).**

# **Epidemiology**

## ❑ Sensitive species

All canids are susceptible to the disease: Domestic dogs, wild dogs, coyotes, wolves, savanna foxes, maned wolves, etc.

## ❑ Viral excretion

- Fecal excretion occurs shortly after viremia between the 3rd and 4th day post-infection (PI) (a few days before the appearance of clinical signs).
- Large amounts of virus are excreted in the feces of clinically affected dogs.
- Fecal excretion generally does not last more than 12 days after infection (rarely reaches 25 days PI).
- It is important to emphasize that there seem to be no chronic excretors.

## □ Importance

- CPV-2 = The most widely recognized cause of transmissible viral diarrhea in dogs.
- Parvovirus = The most common infectious disease in dogs worldwide = Major gastroenteritis.

## □ Virulent materials

- **Feces of infected dogs.**
- Coat contaminated through licking, from sick or recovering dogs.
- Urine and saliva of sick animals.

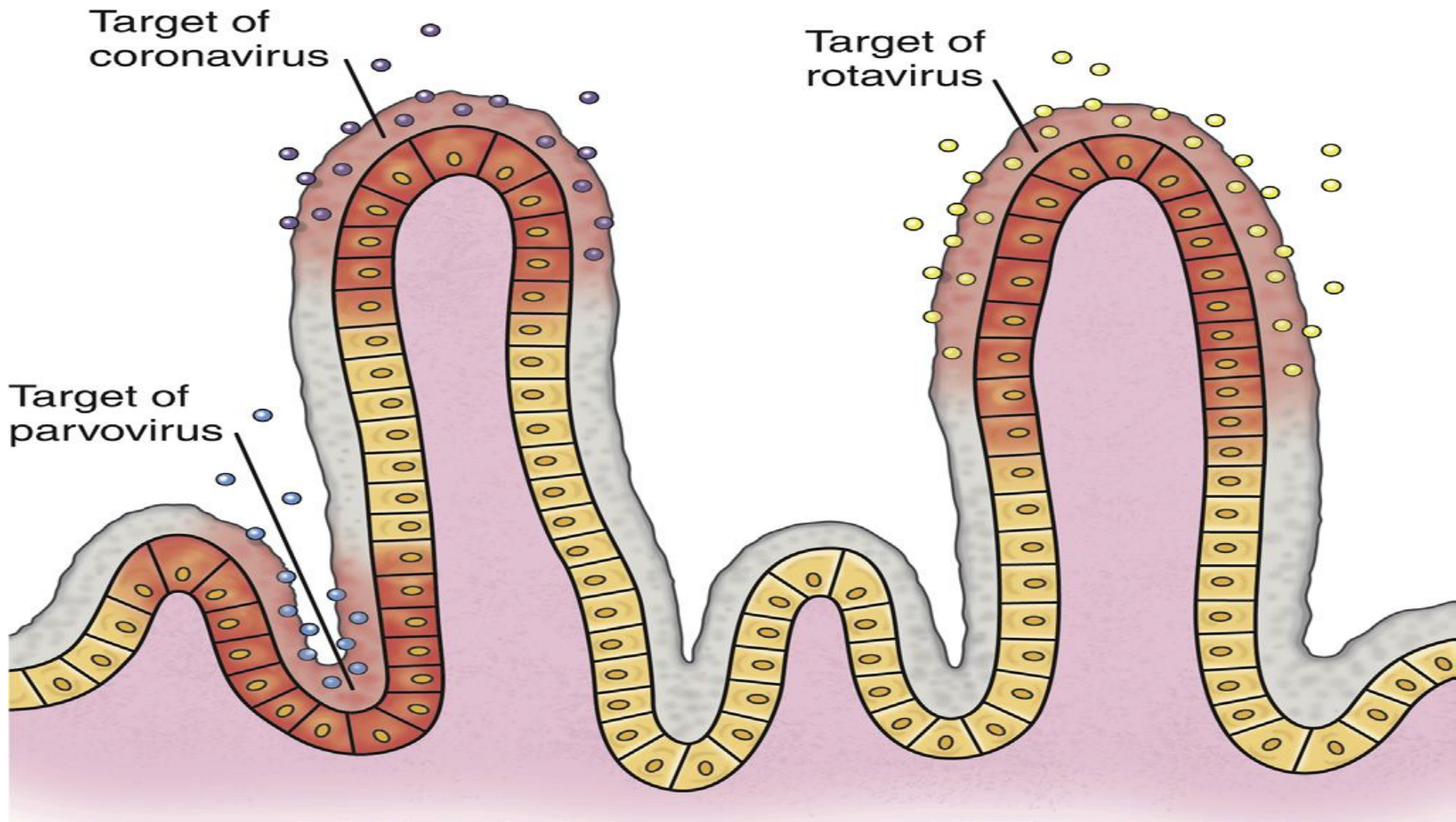
## □ Predisposition and receptivity

- Young animals (6 weeks – 6 months; particularly < 12 weeks old) = corresponds to an << open immune window >>.
- Frequently affected.
- Susceptible to developing the severe form.

➤ The presence of a bacterial, parasitic, or viral co-infection are aggravating factors:

○ **Canine distemper virus, canine enteric coronavirus, rotaviruses, astroviruses, adenoviruses, caliciviruses.**

○ Other viruses: a norovirus, a kobuvirus, a sapovirus, and a circovirus.



Target replication sites of 3 enteric viral pathogens. The most pathogenic enteric viruses, such as canine parvovirus, replicate and destroy the epithelial cells of the crypts.

- May occur in unvaccinated or poorly vaccinated adult dogs.
- **Existence of a racial predisposition: Rottweiler, American pitbull terrier, doberman pinscher, English springer and German shepherd.**
- **Breeding conditions (compliance with cleaning and disinfection measures; compliance with density standards/m<sup>2</sup>, etc.) are determining factors in the development of canine parvovirus.**

## □ Mode of transmission (contagion)

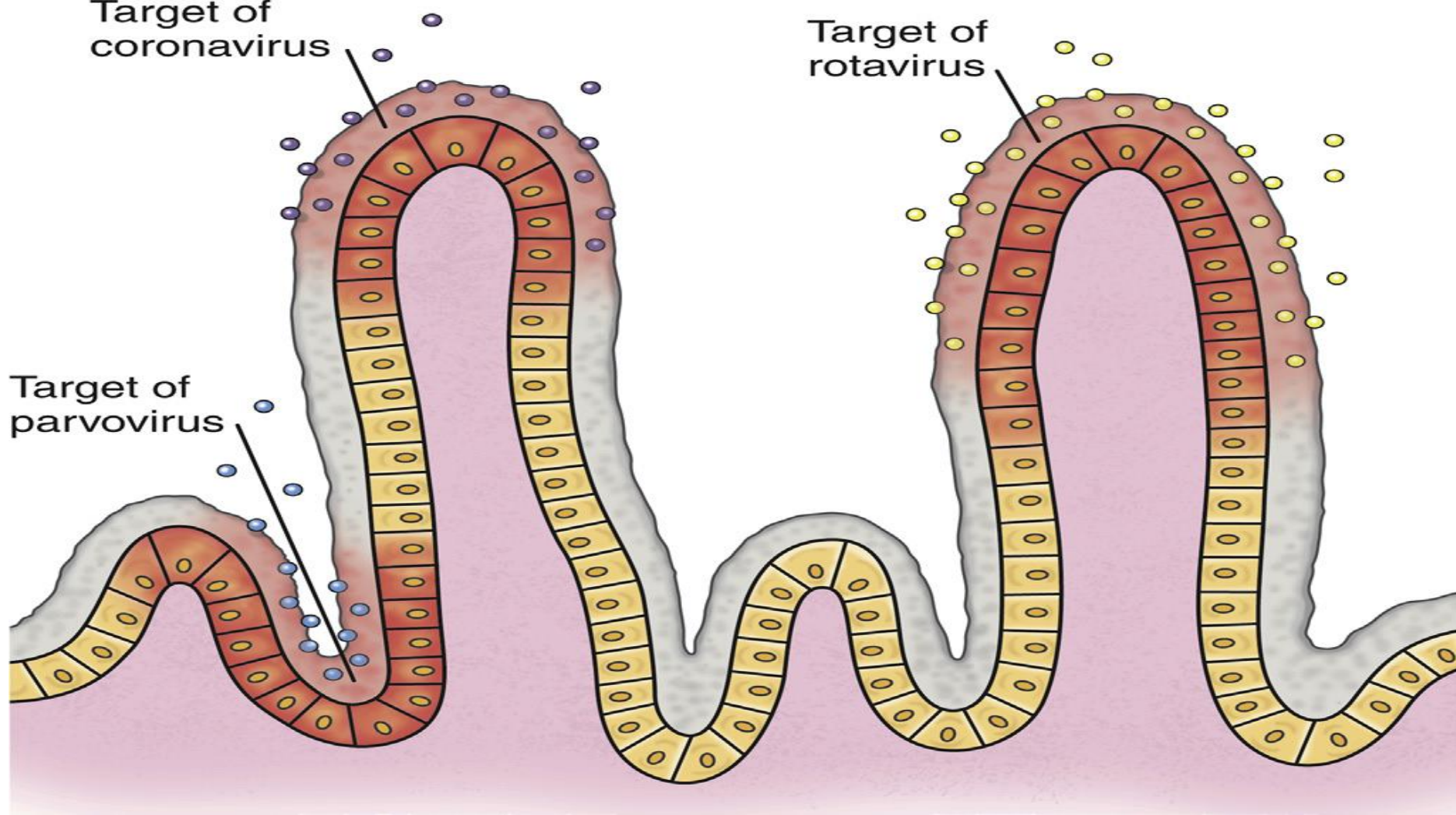
➤ Transmission = direct and/or indirect = oro-fecal route:

- Contaminated feces and food/objects.
- Contaminated fur.
- Insects, rodents = Can also serve as mechanical vectors of the virus.

# **Pathogenicity**

# Tropism

- **CPV-2 requires the presence of mitotically active cells (nucleus in full division) to replicate and targets:**
  - Crypt cells of the intestine (crypt cells of the distal duodenum and jejunum).
  - Lymphoid cells (Peyer's patches, lymph nodes, spleen, thymus) + Hematopoietic stem cells from the bone marrow (particularly granulocytes) + Precursors of erythrocytes.
  - Myocardium in puppies (cardiomyocytes).



Target sites for replication of 3 enteric viral pathogens. The most pathogenic enteric viruses, such as canine parvovirus, replicate and destroy the epithelial cells of the crypts.

- The virus replicates in the target cells.
- Release of virions which leads to the lysis of the host cell.

=

**Necroses**

# Enteritic form

- **Clinical table: Puppies >8 weeks old (6 weeks-16 weeks)**
- **Ingestion of the virus (oral route) through contaminated feces (or vomit content of sick animals).**
- During the first 2 days PI: The virus replicates in the lymphoid tissues of the oropharynx (regional lymph nodes, tonsils).

➤ **Viremia: Occurs 3-5 days PI and lasts 1-5 days.**

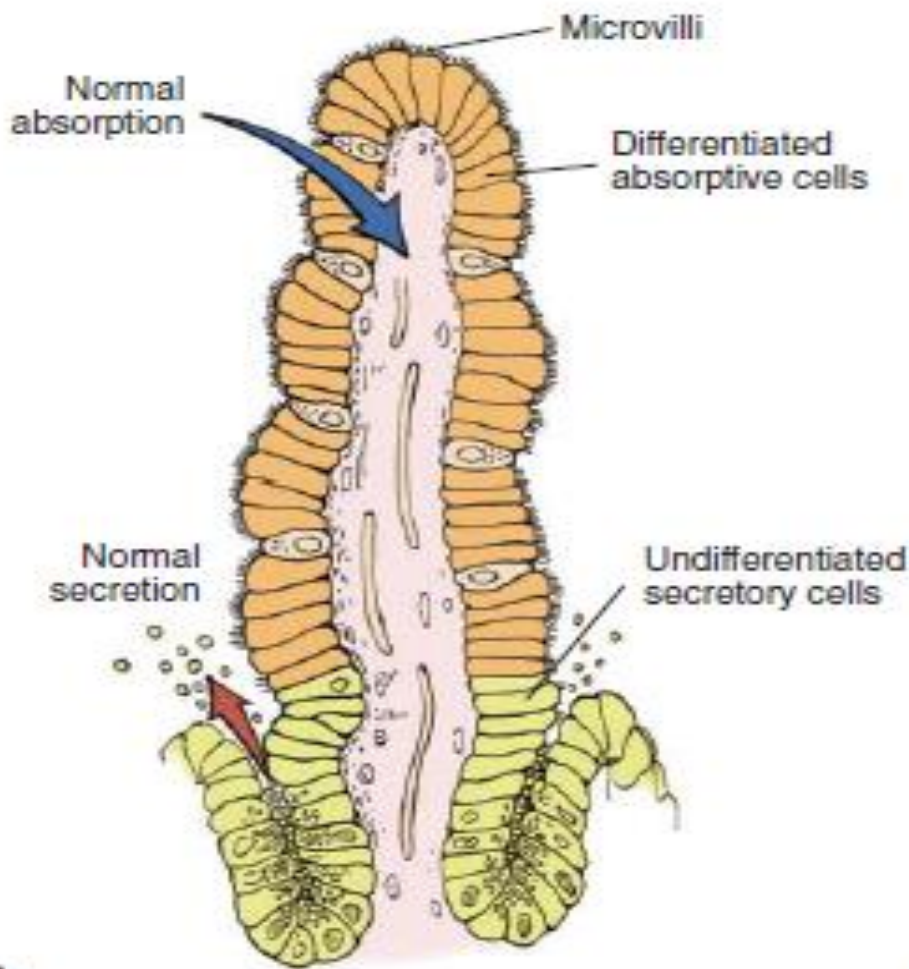
➤ **Location of the virus in the epithelium lining:**

Oral cavity, tongue, esophagus, small intestine, and lymphoid tissues: in particular, the epithelial germinal cells of the crypts of the small intestine.

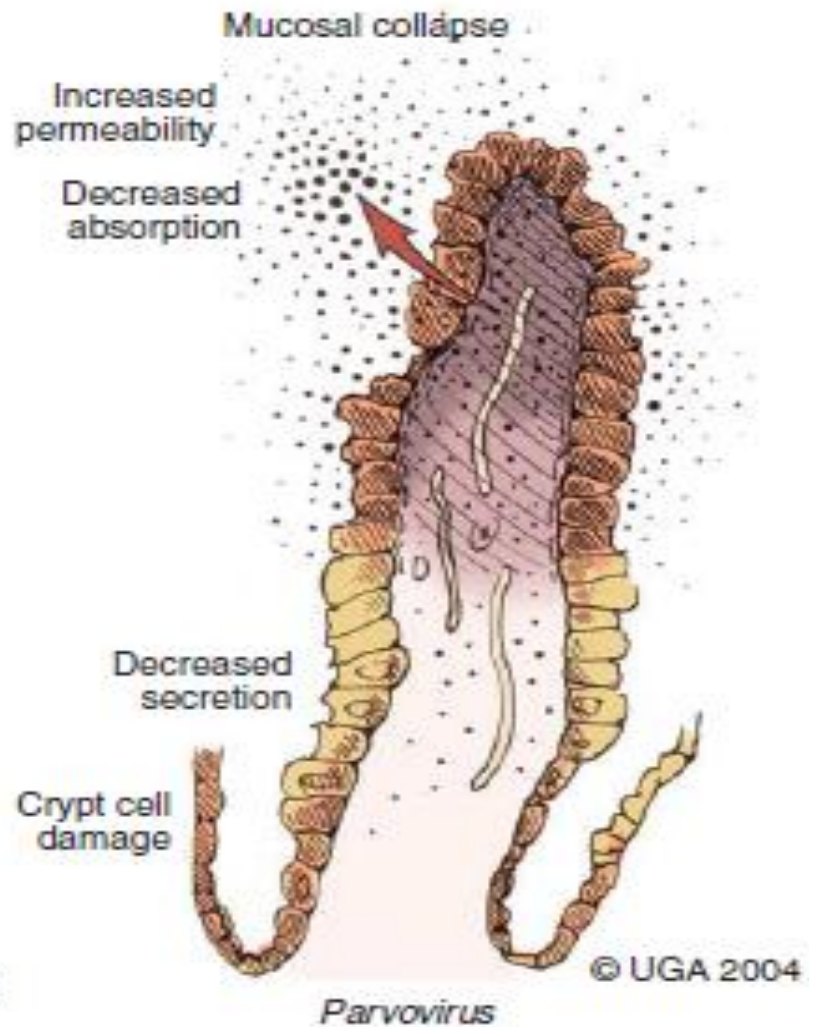
➤ Tissue damage = In rapidly dividing cells of the gastrointestinal tract, thymus, lymph nodes, and bone marrow.

➤ Clinical signs of enteritis do not manifest =  
From the 4th to the 5th day PI.

- **Digestive impairment: Hemorrhagic gastroenteritis = Malabsorption + increased intestinal permeability.**
- **Neutropenia = Bone marrow infection.**
- **Secondary bacterial infections (Gram -) of the gastrointestinal tract = Bacteremia (sepsis), endotoxemia, enteritis.**
- **Disseminated intravascular coagulation (DIC) and Systemic inflammatory response syndrome (SIRS)**



A

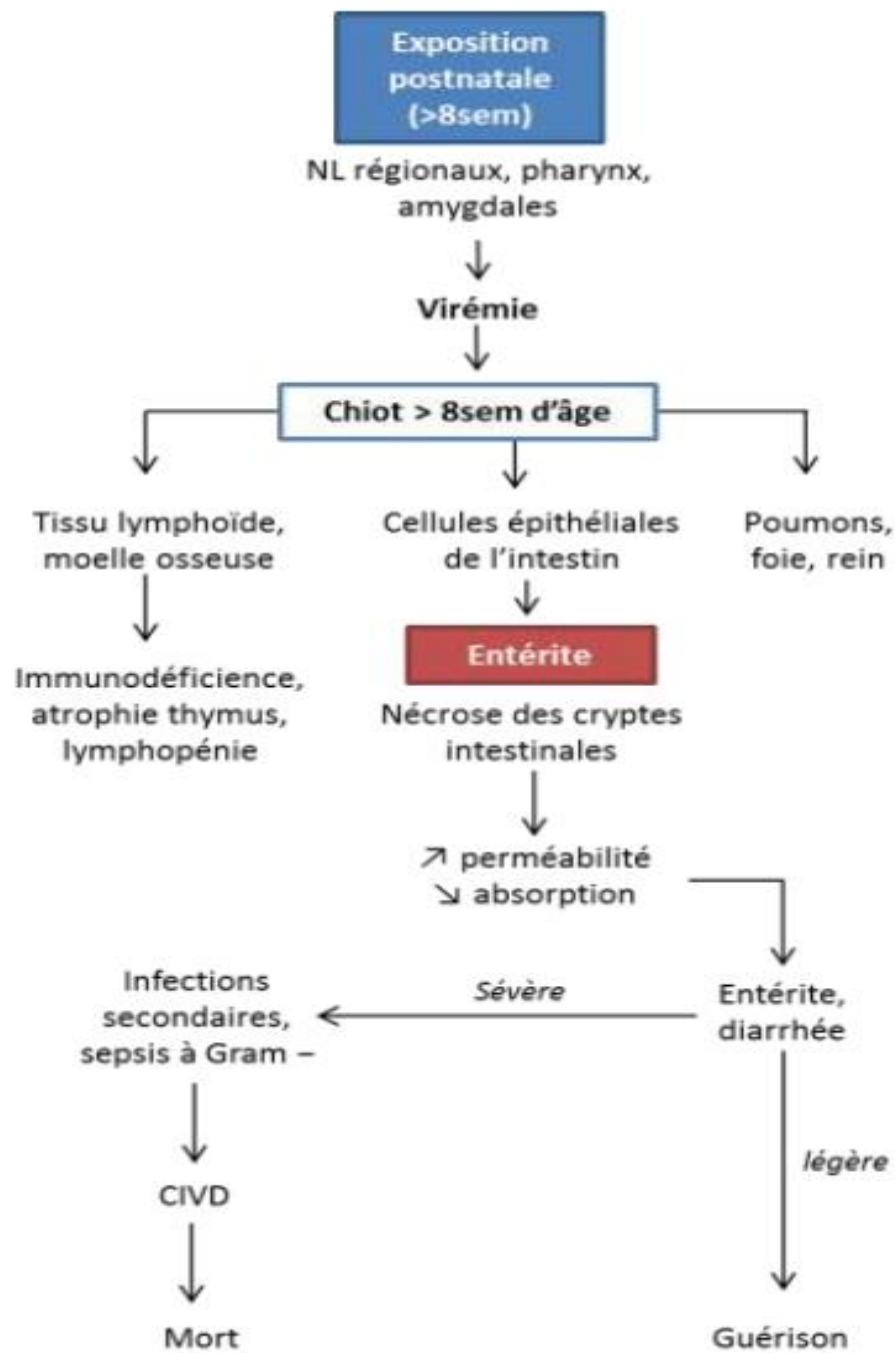
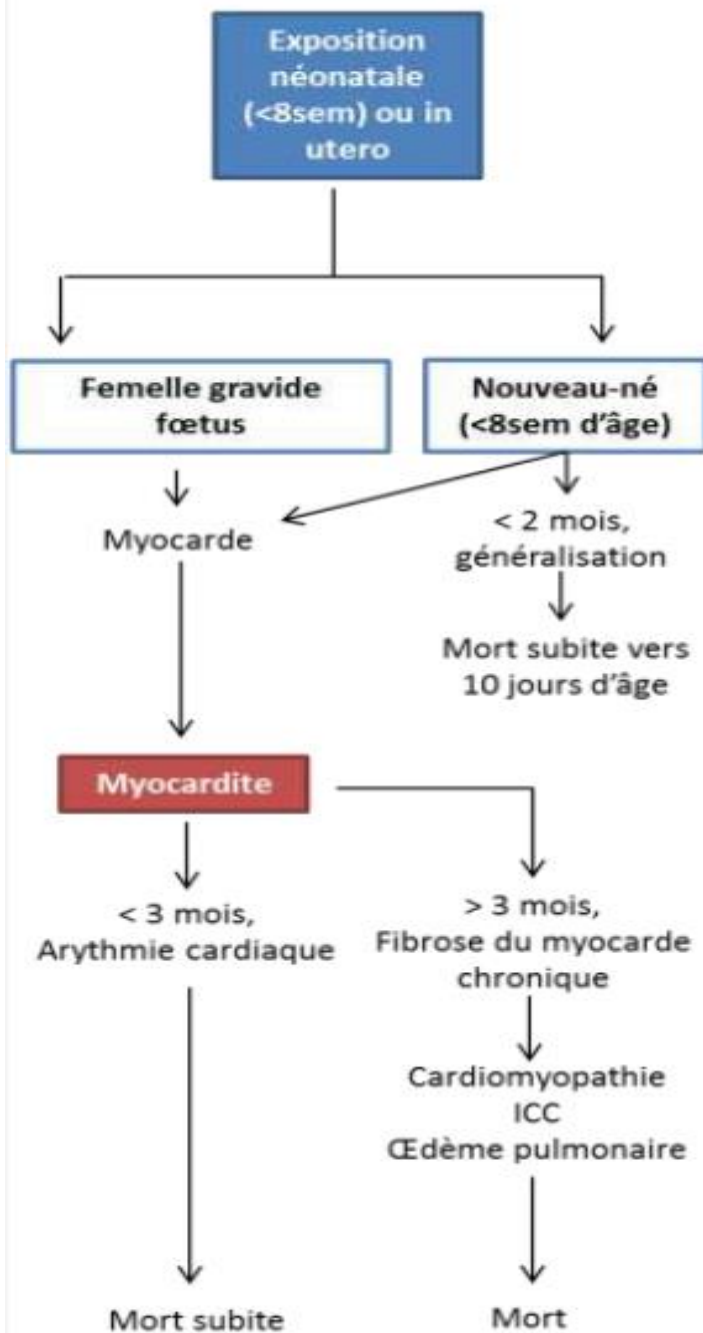


B

A/ Normal intestinal villi showing cellular differentiation along the villi. B/ Villi infected by parvovirus showing collapse and necrosis of intestinal villi.

## Other forms

- Maternal infection by variants of CPV-2 early in pregnancy = Infertility, resorption, abortion.
- Perinatal infection (in utero or just after birth), puppies < 6 weeks of age = Cardiac form = Viral myocarditis:
  - ❖ Sudden death or congestive heart failure, arrhythmia, etc.
  - ❖ Myocardial lesions may occur up to the first 2 weeks of life.
  - ❖ Clinical signs of myocardial lesions may be delayed until 2 months of age.



# **Clinical study**

## **Classic form = Acute enteritic form**

- **Hemorrhagic jejunoileitis (and/or catarrhal).**
- **Major incidence: Puppies aged between 6 to 8 weeks (6 weeks - 16 weeks).**
- **Incubation: 7 to 14 days (<4 days Experimentation).**
- **Fever syndrome  $\approx 41.5^{\circ}\text{C}$  (50%).**
- **Lethargy, dehydration, and anorexia (50%).**

- Hemorrhagic and watery diarrhea (5-100%).
- Vomiting (80%).
- Abdominal pain and liquid-filled intestinal tract upon palpation (15-20%).
- Leukopenia (85-100% in case of repeated examinations).
- Nematodes (ascaris): Feces, anus, vomit of certain dogs.

➤ Coagulation disorders (DIC):

- Signs of hypercoagulability: Thrombosis or phlebitis (catheter) or visceral thrombosis.
- Hemorrhagic diathesis.

➤ Evolution:

- Most animals die from the 2nd to 4th day of the disease.
- Chances of survival increase significantly beyond the 5th day of the disease.

# Cardiac form = Myocarditis

- Acute neonatal myocarditis.
- Clinical onset between 6-8 weeks of age.
- Sudden mortality in very young animals.
- It has the following conditions:
  - Subjects not protected by AOM (absence of AOM, absence of colostrum).
  - Perinatal infection (in utero 5 days before or 5 days after birth).
- Dyspnea, tachypnea, increased lung sounds caused by acute congestive heart failure, sudden death.

# Diagnosis

# Clinic

## Acute gastroenteritis

- High contagiousness, vomiting, hemorrhagic diarrhea, fever, lethargy, and anorexia.
- In a puppy between weaning and 6 months of age (particularly 6 to 12 weeks).

# Differential diagnosis

- Coronaviral disease: Highly contagious, persistent diarrhea (6-14 days), less marked dehydration, low mortality.
- Canine distemper: Respiratory and neurological symptoms, associated with digestive symptoms.

- Leptospirosis: Kidney failure, septicemia.
- Severe helminthosis (ascariasis); Coccidiosis;  
giardiasis: Coprological examination.
- Bacterial enteritis: Salmonellosis;  
campylobacteriosis.

# Paraclinical diagnosis

## ➤ Samples

- Rectal swab, fresh feces. The viral load is maximum: 5 days PI; significantly decreases: 10 days PI.
- Blood sampling allows for serological tests.

## ➤ **Blood formula**

Dominant anomalies =

- **Leukopenia (lymphopenia, neutropenia).**
- **Anemia (intestinal blood loss).**
- **Thrombocytopenia (consumption due to DIC).**

## Complete Blood Count Findings at Admission in 45 Dogs Diagnosed with Canine Parvoviral Enteritis at the UC Davis VMTH

Test	Reference Range	Percent below the Reference Range	Percent within the Reference Range	Percent above the Reference Range	Range for Dogs with CPV Enteritis	Number Tested
Hematocrit (%)	40-55	71	29	0	21-53	45
MCV (fL)	65-75	29	71	0	54-74	45
MCHC (g/dL)	33-36	24	69	7	30-37	45
Neutrophils (cells/ $\mu$ L)	3000-10,500	56	31	13	8-22,453	45
Band neutrophils (cells/ $\mu$ L)	0-rare	0	31	69	0-1582	45
Monocytes (cells/ $\mu$ L)	150-1200	20	60	20	11-2475	45
Lymphocytes (cells/ $\mu$ L)	1000-4000	49	22	0	165-3698	45
Eosinophils (cells/ $\mu$ L)	0-1500	0	100	0	0-1236	45
Platelets (cells/ $\mu$ L)	150,000-400,000	5	60	35	103,000-639,000	43

Note: Adult reference ranges were used by the laboratory.

CPV, Canine parvovirus.

➤ **Biochemistry**

**Hypoalbuminemia, hypokalemia,  
hyponatremia, hypochloremia,  
hypomagnesemia, hypoglycemia.**

➤ **Acid/Base**

○ **Metabolic acidosis (bicarbonate loss).**

**or**

○ **Metabolic alkalosis (severe vomiting).**

## Findings on Serum Biochemistry Analysis in 27 Dogs with Canine Parvoviral Enteritis at the UC Davis VMTH

Test	Reference Range	Percent below the Reference Range	Percent within the Reference Range	Percent above the Reference Range	Range for Dogs with Parvoviral Enteritis	Number of Dogs Tested
Sodium (mmol/L)	145-154	85	15	0	132-147	26
Potassium (mmol/L)	3.6-5.3	4	92	4	3.4-5.9	26
Chloride (mmol/L)	108-118	65	31	4	94-120	26
Bicarbonate (mmol/L)	16-26	8	92	0	14-25	26
Calcium (mg/dL)	9.7-11.5	30	70	0	7.4-11.5	27
Phosphorus (mg/dL)	3.0-6.2	0	52	48	3.1-12.3	27
Creatinine (mg/dL)	0.3-1.2	37	59	4	<0.2-1.6	27
BUN (mg/dL)	5-21	0	85	15	5-48	27
Albumin (g/dL)	3.0-4.4	70	30	0	0.9-3.8	27
Globulin (g/dL)	1.8-3.9	26	67	7	1.4-4.5	27
Cholesterol (mg/dL)	135-361	4	89	8	108-460	26
Total bilirubin (mg/dL)	0-0.2	0	89	12	0-1.7	26
ALT (U/L)	19-67	15	62	23	10-165	26
ALP (U/L)	21-170	0	42	58	56-397	26

Note: Adult reference ranges were used by the laboratory.

## ➤ **Rapid tests**

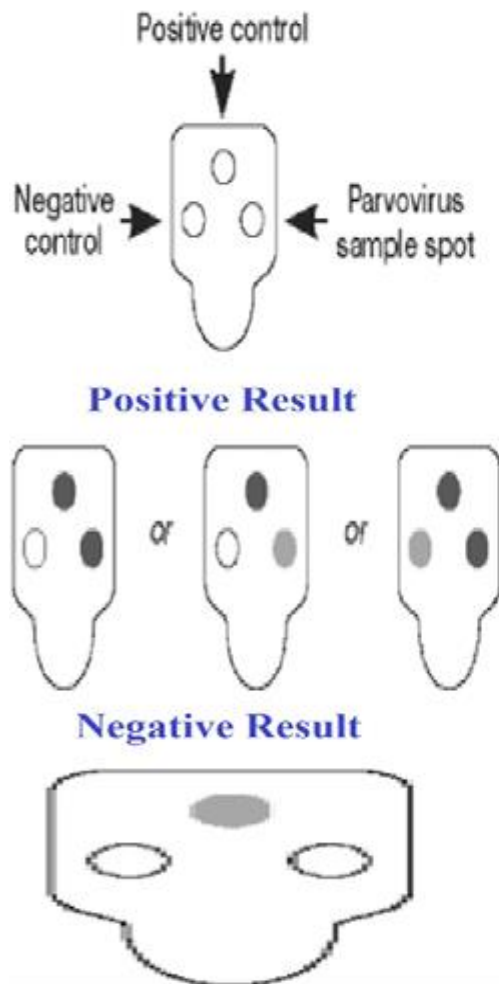
### **Fecal ELISA**

- Detection of fecal antigen (virus)
- Very high specificity.
- False positives may occur within 7 to 10 days following the administration of live attenuated vaccines.
- Detection of several variants of CPV-2.

○ Example :

Fecal parvovirus antigen search

Rapid Test based on  
ELISA technique:  
Snap Parvo Antigen  
Test Kit (IDEXX  
Laboratories)



# Immunochromatography

○ Example:

Speed Parvo Virbac: Search for specific antigens of CPV 2, 2a, 2b, and 2c strains of canine parvovirus = in feces.



## ➤ Hemagglutination test

- Canine parvovirus agglutinates erythrocytes.

Mix a suspension of fecal matter + Porcine

Erythrocytes:

Agglutination of erythrocytes (microplate or on a slide)

**= Presence of parvovirus in feces.**

## ➤ PCR

- Stools, blood, tissues.
- Most sensitive technique.
- Real-time PCR: Determines the viral DNA load.
- Appropriately interpret even after a live attenuated virus vaccination.
- Detect the vaccine virus in feces for at least 2 weeks after vaccination.
- Some kits = Distinction between wild strains and vaccine strains.

## ➤ **Macroscopic lesions**

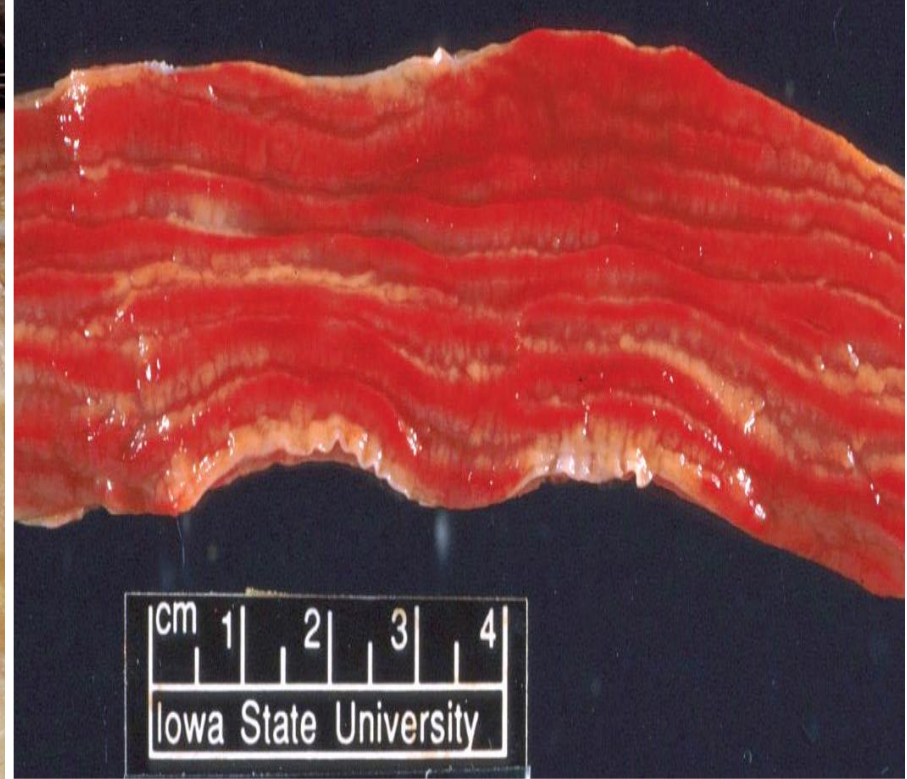
- Thickening, distension, and discoloration of the serosa and the mucosa of the small intestine.
- Watery and bloody material in the gastrointestinal tract.

## ➤ **Histopathology**

- Necrosis of the epithelium of the crypts of the small intestine and depletion of all lymphoid tissue.
- Nuclear inclusions in the epithelium of the crypts.
- Virus detected by in situ hybridization or quantitative PCR applied to tissues.



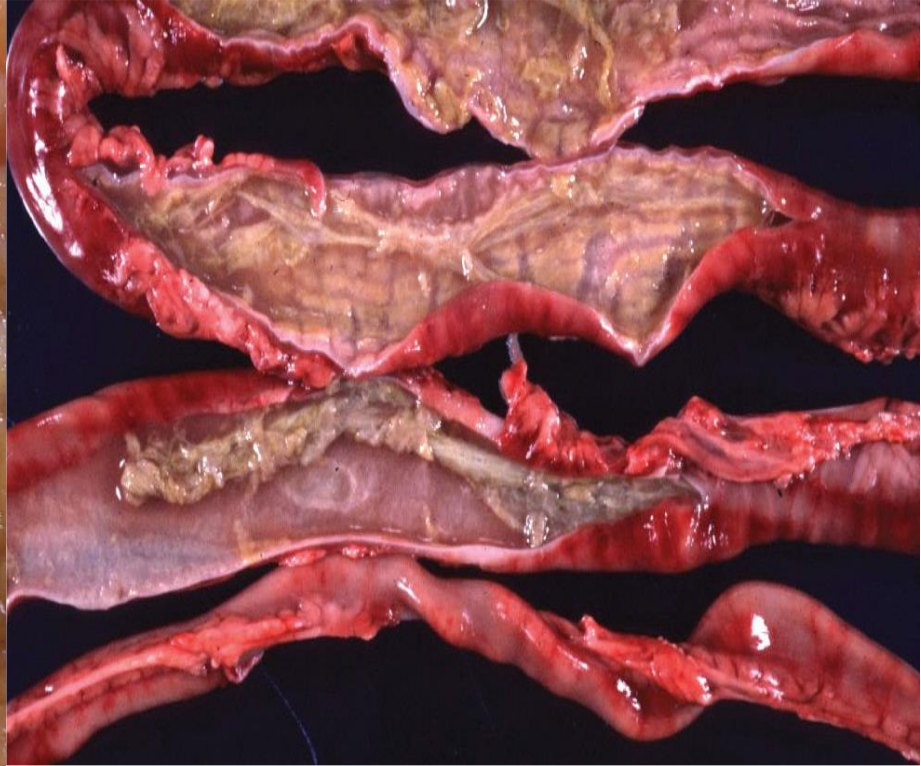
**Discoloration of the small intestinal wall and serous hemorrhage in a puppy that died of parvoviral infection.**



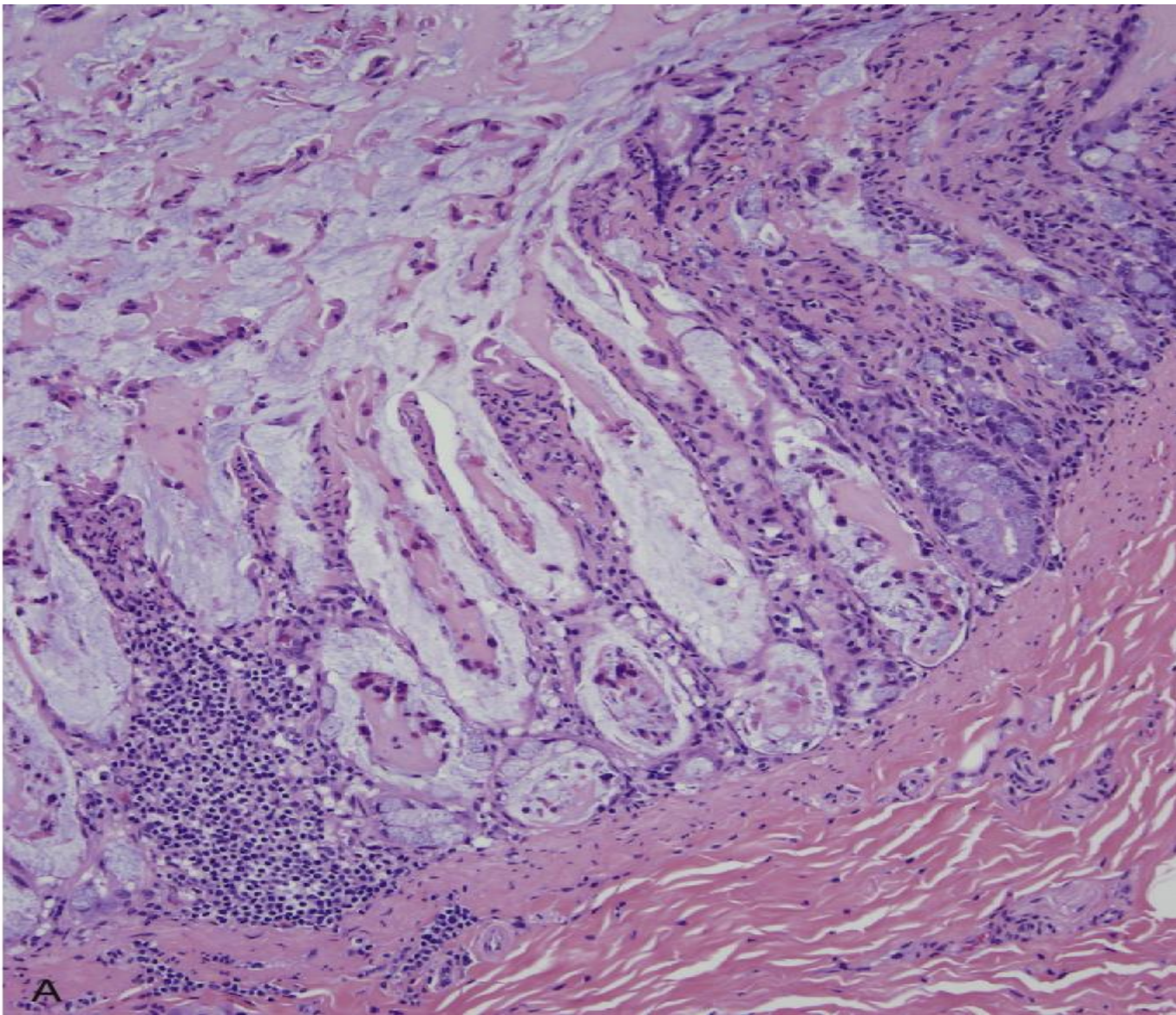
**Parvovirus enteritis: hemorrhagic small intestine.**



**Lymphoid depletion of Peyer's patches in a dog infected with canine parvovirus.**



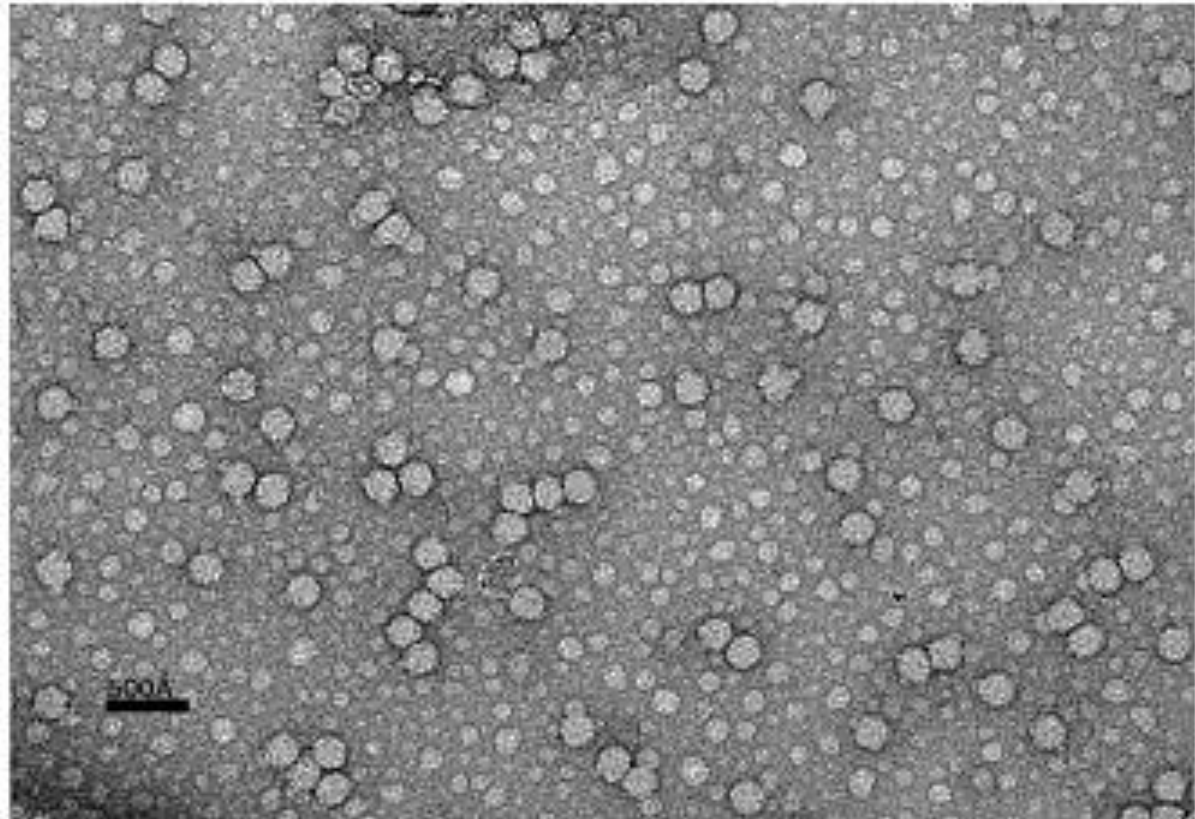
**Necrosis of the small intestine and fibrin deposition in a puppy with severe canine parvovirus infection.**



Necrosis of the ileal crypts in a dog infected with a variant of CPV-2 (H&E).

➤ **Observation of the virus by electron microscopy = reliable.**

The virus is often observed in feces in the form of aggregates



## ➤ **Detection of the virus on cell culture**

CPV2 can be cultured in cells of felids, mustelids, dogs, mice, and humans in vitro.

From the cultures, viral antigens are searched for by immunofluorescence, identification of inclusions, or serum neutralization.

# Prognosis

➤ **Function, in puppies:**

○ **Severity of the disease.**

○ Ability of owners to afford appropriate treatment.

➤ Survival rates are around:

• **9% in untreated puppies.**

• More than 90% with intensive treatment in reference hospitals.

# Treatment

- No specific treatment.
- Symptomatic treatment.
- Hemorrhagic diarrhea: Only use injectable medications during the first days of treatment.
- Intensive care = Hospitalization.

➤ Therapeutic plan for a hospitalized dog suffering from parvovirus:

- Appropriate fluid therapy
- Correction of biochemical and electrolyte imbalances
- Pain management
- Hygiene
- Anti-emetic and Gastrokinetic
- Digestive protector
- Nutrition
- Antibiotic therapy

# Adapted fluid therapy

➤ Rehydration based on clinical criteria:

- Initial skin fold: 4%.
  - Persistent skin fold, sinking of the eyeballs, rapid and small pulse: 8%.
  - Shock state: 10%.
- NaCl 0.9% or Ringer Lactate.


# Estimation of dehydration

DÉSHYDRATATION (%)	ANOMALIES CLINIQUES
<b>Animal hydraté</b>	<b>Aucune</b>
<b>Discrète (&lt; 5 %)</b>	<b>Persistance débutante du pli de peau*, muqueuses mates, absence d'énophtalmie</b>
<b>Modérée (6 – 8 %)</b>	<b>Persistance prononcée du pli de peau*, muqueuses sèches, énophtalmie débutante</b>
<b>Grave (10 – 12 %)</b>	<b>Persistance totale du pli de peau*, muqueuses sèches, hypovigilance, déficits hémodynamiques contemporains (pouls fémoral faible/filant, tachycardie, allongement du temps de recoloration capillaire, hypotension)</b>
<b>Morbide (12 – 15 %)</b>	<b>Stupeur, coma, arrêt cardiorespiratoire</b>

\* Le pli de peau peut être modifié en cas de perte de poids récente à l'origine d'une élasticité cutanée anormale.

- The preferred route of administration is the intravenous route.
- The subcutaneous route can be used in mild dehydration; however, it is contraindicated in animals dehydrated by more than 5% or in a state of hypovolemia due to peripheral vasoconstriction and increased infectious risk.

The infusion volume must take into account = volemia + Infusion plan (Hydration status + maintenance needs + digestive losses):

- An animal showing signs of hypovolemia requires a fluid bolus of 5 to 15 mL/kg administered over 10 to 15 minutes to quickly correct its condition.
- Calculation of the infusion plan: 
- ❑ Correction of dehydration is done over several days by reassessing clinical parameters 3 to 4 times a day to adjust the infusion rate accordingly.
- ❑ Add the animal's maintenance needs, which are 70 ml/kg/day for a puppy or kitten and 50 ml/kg/day for an adult.
- ❑ Take into account the volume of fluids lost during diarrhea or vomiting by estimating the volume of liquid lost and thus regularly adjusting the infusion rate based on losses.

❑ Correction of dehydration (in 24 hours):

**Weight (kg) x % dehydration x 10 =**

**??? ml/24 hours**

❑ Maintenance needs (adult for example):

50 ml/kg/day = ??? ml/24 hours

❑ Correction of losses (diarrhea, vomiting):

**0.5-1 ml/Kg/hours**

Example:

The calculation of the infusion plan (over 24 hours) for an adult dog weighing 30 kg, dehydrated by 10% who presents with vomiting and diarrhea.

❑ Correction of dehydration (in 24 hours)

$30 \text{ kg} \times 10 \% \text{ dehydration} \times 10 = 3000$   
ml/24 hours.

❑ Maintenance needs

$50 \text{ ml/kg/day} = 1500 \text{ ml/24 hours}$ .

❑ Correction of losses (diarrhea, vomiting)

Estimated losses of 500 ml = 500 ml/24  
hours.

TOTAL

$$= 1500 + 3000 + 500 = 5000 \text{ ml/24 hours}$$

That is 5l to infuse in 24 hours

That is 208.3 ml/hour

## ➤ **Alternative protocols**

- Due to the high cost of traditional parvovirus treatment, some authors have proposed an alternative treatment protocol.
- This protocol allows patients to receive outpatient treatment = promising results = survival rates reaching 80%.

- Immediately after the patient is admitted and before they are sent home, cardiovascular parameters must be stabilized by administering:

IV bolus of isotonic crystalloid for 15 to 20 minutes and correcting severe hypoglycemia.

At home:

- SC crystalloid fluids (NaCl 0.9), administered every 8 hours:
- Total volume = 120 ml/kg/day + replacement for dehydration.
- Divide the total daily volume by 3.

# Fighting against electrolyte imbalances

## ➤ Correction of imbalances:

- Hypoglycemia, hypokalemia must be managed by supplementing the infusion.
- Plasma concentrations of glucose, total proteins, albumin, electrolytes, and hematocrit are monitored daily in animals affected by parvoviral infection.

➤ Filling of blood vessels:

Patients with severe hypoproteinemia (hypoalbuminemia) may need (hypovolemia):

- Total blood transfusion.
- Plasma transfusion

or

- Synthetic colloids (e.g., plasma gel, starch (hydroxyethyl starch), or dextran 70).

- Transfusion (Total Blood) = 10-20 ml/kg IV: as needed.
- PlasmaGel = 10-20 mL/kg IV: as needed.
- Dextran = 20 mL/kg IV 24: unique dose

➤ If blood parameters cannot be measured, it is recommended to add (to the IV infusion fluid):

- 20-40 mEq/l of potassium chloride

(Avoid exceeding the threshold of cardiotoxicity related to potassium supplementation = 0.5 mEq/kg/h

AND

- Dextrose 2.5-5 % (50-100 mL of 50 % dextrose per liter of replacement fluid).

# Antiemetics, gastrokinetics, and digestive protectants

## ➤ Digestive protectants

- Sucralfate: Decreases the absorption of other orally administered molecules and should be spaced at least 2 hours apart from other oral treatments.
- Omeprazole: 0.5-1 mg/kg/day
- Ranitidine (1–2 mg/kg IV q12h or PO 1 to 2 times a day)
- Cimetidine (4–10 mg/kg SC, IM, IV q6h)

- Slow down gastrointestinal transit
  - Antispasmodics block transit.
  - Parvovirus can lead to: Cessation of transit associated with painful ileus = Antispasmodics under these conditions = Worsens ileus and can induce intussusceptions = To be avoided.

- Bromide of pheniperidinium (prifinial) 0.75 mg/kg.
- Hordenine sulfate (Hordénol) 1-4 mg/kg.
- Loperamide: 0.04-0.2 mg/kg 3 times/day.
- Antidiarrheals of the smectite type are reserved for the convalescent period (cessation of hemorrhage).
- Antispasmodic: Metamizole, Spasmoglucinol.

## ➤ **Anti-emetic treatments**

Can be used:

- Maropitant citrate 1 mg/kg SC q24.
- Atropine sulfate 0.05 mg/kg SC.
- Haloperidol 0.02 mg/kg SC.
- Metoclopramide 0.2-0.4 mg/kg SC q 8.

Drug	Dosage <sup>a</sup> (mg/kg)	Route	Interval (hr)
<b>ANTIEMETIC AGENTS</b>			
Chlorpromazine	0.5	IM	8
	1.0	Rectally	8
	0.2–0.5	IV	8
Metoclopramide	0.2–0.4	SC	8
	1–2	IV <sup>b</sup>	24
Prochlorperazine	0.1	IM	6–8
Ondansetron	0.1–0.15	IV	6–12
Dolasetron	1	IV, PO	24

# Nutritional support

- Early enteral nutrition: From the first day of treatment  
(via a nasoesophageal tube)

The most effective action in patient management.

- Some authors: Total diet of 24-48 hours followed by a maldigestion malabsorption diet;
- After 4-5 days (in case of cessation of vomiting and hemorrhagic diarrhea): pasta, cottage cheese, rice, lean meat.

➤ Several studies highlight the importance of early enteral nutrition in the treatment of parvovirus =  
A faster clinical improvement, a significant weight gain.



Sonde d'alimentation naso-gastrique mise en place chez un chiot atteint de parvovirose.

# Antibiotic therapy

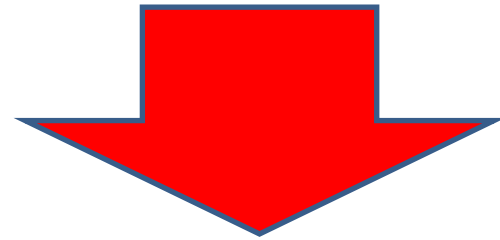
Antibiotic therapy is indicated in the majority of cases, due to acute enteritis = rupture of the epithelial barrier + leukopenia.

- IV antibiotic therapy, broad spectrum and bactericidal is recommended.
- The combination of amoxicillin and clavulanic acid or ampicillin (20 mg/kg) and sulbactam IV 3 times a day is the first-choice antibiotic therapy.
- Metronidazole at 15 mg/kg IV twice a day may be added.

- Fluoroquinolones: Enrofloxacin (5 mg/kg IM, IV every 24 hours)
- Cephalosporins (cefoxitin, ceftazidime and cefovecin): Cefazolin (22 mg/kg IV q8h)

Drug	Dosage <sup>a</sup> (mg/kg)	Route	Interval (hr)	Duration (days)
<b>ANTIMICROBIAL AGENTS</b>				
Ampicillin	10–20	IV, IM, SC	6–8	3–5
Cefazolin	22	IV, IM	8	3–5
Ceftiofur	2.2–4.4	SC	12	3–5
Gentamicin <sup>c</sup>	6–8	IM, SC, IV	24	3–5
Interferon- $\omega$	$2.5 \times 10^6$ units/kg	IV	24	3

- In case of signs of sepsis appearing despite initial antibiotic therapy, gentamicin may be added (6 mg/kg IV every 24 hours).



However, it is contraindicated in cases of dehydration or kidney disease.

# Diverse Therapy

## ➤ **Fight against systemic inflammatory response syndrome (SIRS):**

- Dexamethasone = 2-4 mg/kg IV: single dose.
- Flunixin meglumine = 1 mg/kg IV: single dose.

## ➤ **Fight against endotoxemia:**

- Anti-endotoxin serum (SEPTI-serum for example) to neutralize endotoxins from Gram-negative bacteria.

## ➤ Control abdominal pain:

Analgesics help relieve the affected animal and improve its comfort.

Morphine slows down transit, which is already paralyzed during parvoviral infection. It is recommended to use molecules that have a less pronounced effect on transit:

- Buprenorphine
- Butorphanol (Torbugésic®), morphine-based)
- Methadone.

- Interferon omega: Feline-origin interferon (Virbagen Omega®) = 2.5 million units/kg q24h for 3 consecutive days



# Prophylaxis

# Sanitary

- Disinfecting the premises: Diluted bleach (1/30), Vikron.
- Raising.
- Periodically carry out a sanitary emptying and disinfection in a room (or several rooms).
- Identify animals at major risk.

# Medical

## Guidelines for Vaccination of Individual Pet Dogs

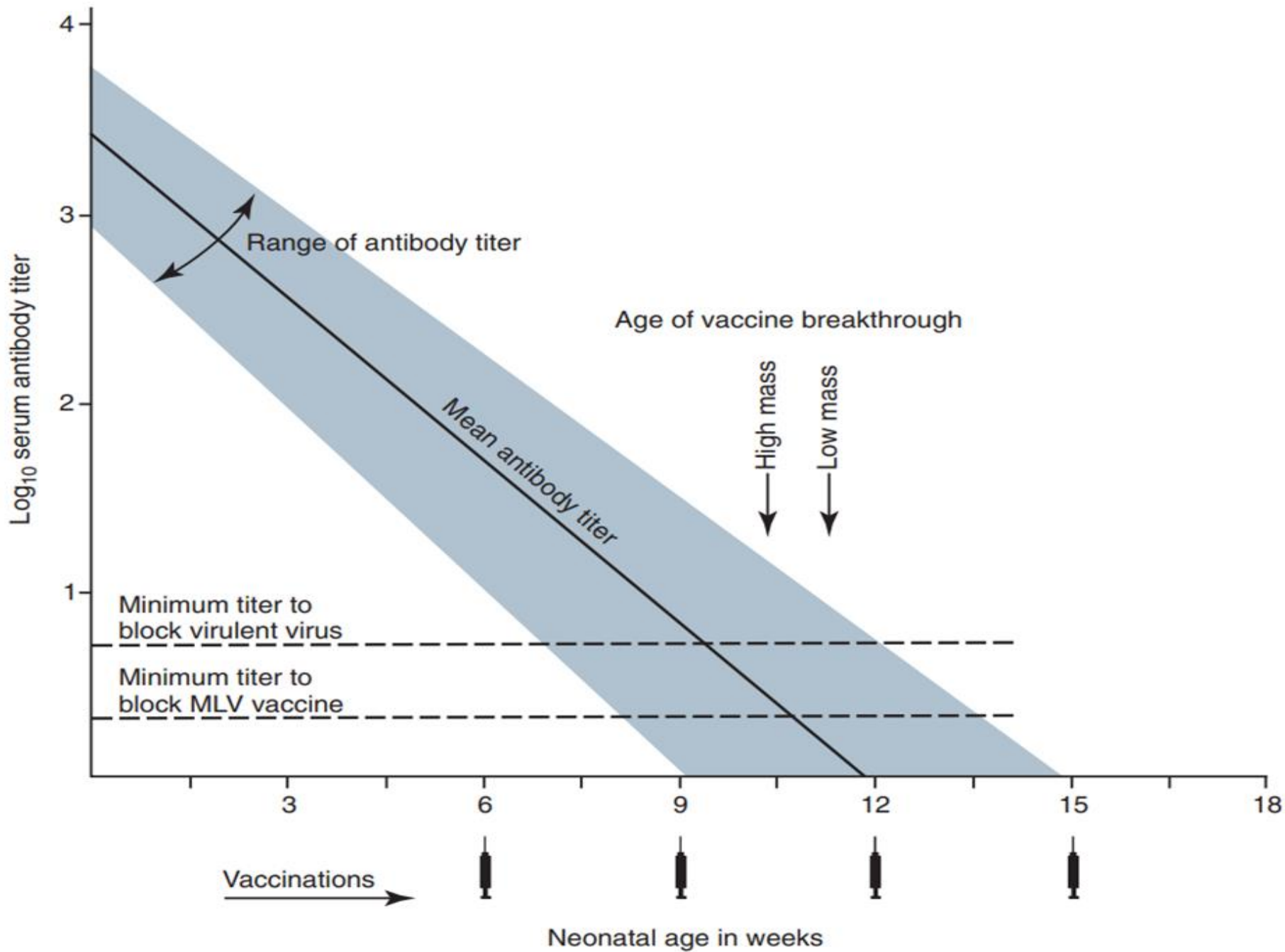
Vaccine	Initial Vaccination		Booster Schedule	Comments
	Age ≤ 16 Weeks	Age > 16 Weeks		
CPV-2 (A, SC)	6-8 weeks of age, then every 3-4 weeks until no sooner than 14-16 weeks (16-20 weeks in breeding kennels)	Two doses 3-4 weeks apart recommended, but one dose is considered protective	1 year, then every 3 years thereafter	<b>Core.</b> Protection after the 12-month booster may be lifelong. Administer with vaccines for CDV and CAV-2.
CPV-2 (I, SC)				Not recommended when attenuated vaccines are available and indicated

## Guidelines for Vaccination of Dogs in Shelter Environments

Vaccine	Initial Vaccination		Recommendations for Booster at Exit	Comments
	Age ≤ 16 Weeks	Age > 16 Weeks		
CPV-2 (A, SC)	On entry no earlier than 6 weeks of age,* then every 2-3 weeks until no sooner than 16 weeks (and up to 20 weeks if outbreaks occur)	Two doses 2-3 weeks apart recommended, but one dose is considered protective	1 year, then every 3 years thereafter.	<b>Core.</b> Potential to provide strong protection. Do not use in pregnancy. Administer with vaccines for CDV and CAV-2.
CDV (A, SC)	On entry no earlier than 6 weeks of age,* then every 2-3 weeks until no sooner than 16 weeks (up to 20 weeks when outbreaks occur)	Two doses 2-3 weeks apart recommended, but one dose is considered protective	1 year, then every 3 years thereafter	<b>Core.</b> Potential to provide strong protection. Do not use in pregnancy. Administer with CPV and CAV-2 vaccines.

A, attenuated live; I, inactivated whole organism; SC, subcutaneous.

Immunization can be performed as early as 4-5 weeks in the face of an outbreak.



# **Public health**

Canine parvovirus is not considered a zoonosis  
(CPV-2 does not infect humans).