Canine Parvovirus

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- Canine parvovirus is a highly contagious virus that commonly causes GI disease in young, unvaccinated dogs.
- Presenting signs include anorexia, lethargy, vomiting, and diarrhea, which is often hemorrhagic.
- Diagnosis is typically based on history, physical examination findings, and fecal antigen testing.
- Treatment is largely supportive on an inpatient or outpatient basis because specific therapies are not available.
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- **Highly contagious and relatively common cause** of acute, infectious GI illness in young and/or unvaccinated dogs.
- Nonenveloped, single-stranded DNA virus, resistant to many common detergents and disinfectants, as well as to changes in temperature and pH.
- Infectious CPV can persist indoors at room temperature for at least 2 months; outdoors, if protected from sunlight and desiccation, it can persist for many months and possibly years.
- Clinical disease is largely attributed to CPV-2b; however, infection with a newer and equally virulent strain, CPV-2c, is increasingly common.
- To date, no association has been identified between CPV strain and severity of clinical disease.

Canine Parvovirus

- Young (6 week to 6 month old), unvaccinated or incompletely vaccinated dogs are most susceptible.
- Breeds described as at increased risk include:
  - Rottweilers
  - Doberman Pinschers
  - American Pit Bull Terriers
  - English Springer Spaniels
  - German Shepherds

Canine Parvovirus

- Assuming sufficient colostrum ingestion, puppies born to a dam with CPV antibodies are protected from infection for the first few weeks of life; however, susceptibility to infection increases as maternally acquired antibody wanes.
- Stress (eg, from weaning, overcrowding, malnutrition, etc), concurrent intestinal parasitism, or enteric pathogen infection(eg, *Clostridium* spp, *Campylobacter* spp, *Salmone lla* spp, *Giardia* spp, coronavirus) have been associated with more severe clinical illness.
- Among dogs >6 months old, intact male dogs are more likely than intact female dogs to develop CPV enteritis.
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Canine Parvovirus

- Virus is shed in the feces of infected dogs within 4–5 days of exposure (often before clinical signs develop), throughout the period of illness, and for ~10 days after clinical recovery.
- Infection is acquired through direct oral or nasal contact with virus-containing feces or indirectly through contact with virus-contaminated fomites (eg, environment, personnel, equipment).
- Viral replication occurs initially in the lymphoid tissue of the oropharynx, with systemic illness resulting for subsequent hematogenous dissemination.
- CPV preferentially infects and destroys rapidly dividing cells of the small-intestinal crypt epithelium, lymphopoietic tissue, and bone marrow.
- Destruction of the intestinal crypt epithelium results in epithelial necrosis, villous atrophy, impaired absorptive capacity, and disrupted gut barrier function, with the potential for bacterial translocation and bacteremia.
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Canine Parvovirus

- Lymphopenia and neutropenia develop secondary to destruction of hematopoietic progenitor cells in the bone marrow and lymphopoietic tissues (eg, thymus, lymph nodes, etc) and are further exacerbated by an increased systemic demand for leukocytes.
- Infection in utero or in pups <8 weeks old or born to unvaccinated dams without naturally occurring antibodies can result in myocardial infection, necrosis, and myocarditis. Myocarditis, presenting as acute cardiopulmonary failure or delayed, progressive cardiac failure, can be seen with or without signs of enteritis. However, CPV-2 myocarditis is infrequent, because most bitches have CPV antibodies from immunization or natural exposure.
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- Clinical signs of parvoviral enteritis **generally develop within 5–7 days of infection** but can range from 2–14 days.
- Initial clinical signs may be nonspecific (eg, lethargy, anorexia, fever) with progression to vomiting and hemorrhagic small-bowel diarrhea within 24–48 hours.
- Approximately 25% of dogs may have nonhemorrhagic diarrhea.
- Physical examination findings can include depression, fever, dehydration, and intestinal loops that are dilated and fluid filled.
- Severely affected animals may present collapsed with prolonged capillary refill time, poor pulse quality, tachycardia, and hypothermia—signs potentially consistent with septic shock.
- Although CPV-associated leukoencephalomalacia has been reported, CNS signs are more commonly attributable to hypoglycemia, sepsis, or acid-base and electrolyte abnormalities.

Canine Parvovirus

- Dogs suspected or confirmed to have canine parvovirus should be immediately isolated from other dogs to prevent spread of infection
- Treatment is based on supportive care, including fluid and electrolyte therapy, nutritional support, anti-emetics, and antibiotics

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- The main goals of treatment for canine parvovirus enteritis include restoration of fluid, electrolyte, and metabolic abnormalities and prevention of secondary bacterial infection.
- In the absence of significant vomiting, oral electrolyte solutions can be offered.
- Administration SC of an isotonic balanced electrolyte solution may be sufficient to correct mild fluid deficits (<5%) but is insufficient for dogs with moderate to severe dehydration.
- Most dogs will benefit from IV fluid therapy with a balanced electrolyte solution.
- Correcting dehydration, replacing ongoing fluid losses, and providing maintenance fluid needs are essential for effective treatment.
- Dogs must be monitored for development of hypokalemia and hypoglycemia.
- If electrolytes and serum blood glucose concentration cannot be routinely monitored, empirical supplementation of IV fluids with potassium (potassium chloride 20–40 mEq/L) and dextrose (2.5%–5%) is appropriate.
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Canine Parvovirus

- If GI protein loss is severe (albumin <2.0 g/dL, total protein <4.0 g/dL, evidence of peripheral edema, ascites, pleural effusion, etc), colloid therapy should be considered.
- Nonprotein colloids (eg, pentastarch, hetastarch) can be administered in boluses (5 mL/kg, maximum of 20 mL/kg) throughout at least 15 minutes. The remainder of the maximal dosage of 20 mL/kg can be administered as a constant-rate infusion throughout 24 hours, with the volume of crystalloids administered decreased by 40%–60%.
- TTransfusion of fresh frozen plasma may partially replace serum albumin while providing serum protease inhibitors to counter the systemic inflammatory response.
- There is no evidence to support the use of serum from dogs recovered from CPV enteritis (convalescent or hyperimmune serum) as a means of passive immunization.
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Canine Parvovirus

- Antibiotics are indicated because of the risk of bacterial translocation across the disrupted intestinal epithelium and the likelihood of concurrent neutropenia.
- A beta-lactam antibiotic (eg, ampicillin or cefazolin [22 mg/kg, IV, three times daily]) will provide appropriate gram-positive and anaerobic coverage.
- For severe clinical signs and/or marked neutropenia, additional gram-negative coverage (eg, enrofloxacin [5-10 mg/kg/day, IM or IV] or gentamicin [9-12 mg/kg/day, IV]) is indicated.
- Aminoglycoside antibiotics must not be administered until dehydration has been corrected and fluid therapy established. Enrofloxacin has been associated with articular cartilage damage in rapidly growing dogs 2–8 months old and should be discontinued if joint pain or swelling develops.
- Second- or third-generation cephalosporins (eg, cefoxitin, ceftazidime, cefovecin, others) can also be considered for their relatively wide spectrum of activity against gram-positive and gram-negative bacteria. Antibiotic therapy is typically only needed for a short duration (eg, 5–7 days).
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Canine Parvovirus

- Antiemetic therapy: In dogs with CPV enteritis, maropitant (1 mg/kg/day, IV) and ondansetron (0.5 mg/kg, IV, three times daily) appear to be equally effective at controlling vomiting. Metoclopramide (0.3 mg/kg, PO or SC, twice daily, or 1–2 mg/kg/day as a constant-rate infusion) may be considered as an antiemetic as well as for its prokinetic effects, particularly in dogs with significant gastric stasis.
- Antidiarrheals are not recommended, because retention of intestinal contents within a compromised gut increases the risk of bacterial translocation and systemic complications.

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- To limit environmental contamination and spread to other susceptible animals, dogs with confirmed or suspected CPV enteritis must be handled with strict isolation procedures (eg, isolation housing, gowning and gloving of personnel, frequent and thorough cleaning, footbaths, etc).
- All surfaces should be cleaned of gross organic matter and then disinfected with a solution of dilute bleach (1:30) or a peroxygen, potassium peroxymonosulfate, or accelerated hydrogen peroxide disinfectant. The same solutions may be used as footbaths to disinfect footwear.
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- To prevent and control CPV, **vaccination with a modified-live vaccine is recommended** at 6–8, 10–12, and 14–16 weeks of age, followed by a booster administered 1 year later and then every 3 years.
- Because of potential damage by CPV to myocardial or cerebellar cells, inactivated rather than modified-live vaccines are indicated in pregnant dogs or colostrum-deprived puppies vaccinated before 6–8 weeks of age.

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- In a kennel, shelter, or hospital situation, cages and equipment should be cleaned, disinfected, and dried twice before reuse.
- Removal of contaminated organic material is important in outdoor situations where complete disinfection is not practical.
- Disinfectants can be applied outdoors with spray hoses, but disinfection will be less effective than when applied to clean, indoor surfaces.
- In a home situation, only fully vaccinated puppies (at 6, 8, and 12 weeks) or fully vaccinated adult dogs should be introduced into the home of a dog recently diagnosed with CPV enteritis. Booster vaccination of in-contact healthy dogs that are up-to-date on parvovirus vaccination is reasonable but potentially unnecessary given the extended duration of immunity to CPV.
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- Canine parvovirus is a highly contagious cause of acute GI disease in young, unvaccinated dogs.
- Diagnosis is based on signalment, history, presenting signs, and fecal viral antigen testing or viral PCR testing.
- Treatment requires supportive care with fluids, antiemetics, antibiotics, and nutritional support.
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