Diagnosis of parvovirus
Quick recognition of clinical signs and confirmation of parvovirus infection is the first step towards successful management of this disease. Classic parvovirus enteritis is characterized by severe vomiting, followed by hemorrhagic diarrhea, anorexia, dehydration, and lethargy. In-house fecal enzyme-linked immunosorbent assay (ELISA) antigen tests are the most commonly used diagnostic tests for parvovirus. All young dogs with consistent clinical signs should be tested for parvovirus. Although sensitivity of fecal ELISAs has varied, specificity is consistently high. If testing is delayed 5 days after onset of clinical signs, false negative test results may occur due to decreased viral shedding. A false negative may rarely occur if a viral mutation prevents identification by the ELISA test. If a false negative is suspected, PCR or virus isolation from a fecal sample can be submitted for further analysis. PCR and DNA sequencing are available to distinguish between variants of CPV (2b and 2c); however this information may not be clinically relevant for clinicians. Additional diagnostic testing should also be performed including minimally a PCV/TS, blood glucose, blood smear (to evaluate number of neutrophils), and fecal flotation. Ideally, a CBC and chemistry would also be performed to assess the patient’s status and assist in developing an optimal treatment plan.

Isolation of puppies with parvovirus
Once a diagnosis of parvovirus has been confirmed, it is important to quarantine parvovirus puppies in an isolation ward to minimize potential transmission to other dogs within the hospital population. An isolation ward should be cleaned thoroughly between patients and fully stocked with basic equipment (stethoscope, thermometer, fluid pump, IV catheter kit, etc.) to prevent cross-contamination between isolation and traditional wards. Limited personnel should be permitted to enter isolation, to decrease exposure and risk of transmission via fomites to other patients. To minimize spread of disease to neutropenic parvovirus puppies, all personnel entering isolation should wash their hands and use a footbath prior to entry, and should wear a cap, gown, booties, and gloves throughout the visit. Intravenous catheters should be placed as steriley as possible and well maintained, as bacterial colonization of IV catheters is a reported and potential complication for this population of dogs. Personnel should use the footbath again on exit, and wash hands thoroughly with soap and water (ideally) or gel sanitizer. Staff should be reminded that dogs with parvovirus are extremely immunosuppressed, and there should be equal concern for what microbes we bring into isolation as what we bring out of isolation.

Treatment strategies for parvovirus puppies
Therapy for dogs with parvovirus is supportive, with the goals of rehydration, correcting and maintaining electrolyte and glucose abnormalities, and providing antimicrobial and antiemetic support. Fluid rates should be calculated based on percent dehydration (8% dehydrated equates to 0.08xbody weight in kilograms to determine the number of liters of fluid to replace) plus maintenance needs (60ml/kg/day). A replacement isotonic fluid such as LRS or 0.9% saline is typically appropriate, although many good options exist. Most puppies require dextrose supplementation (2.5%-5%) as well as potassium chloride, and inclusion of these supplements should be based on initial lab work findings. Fresh frozen plasma can be beneficial as oncotic support for dogs who are losing excessive proteins through their gastrointestinal tracts and for dogs who develop DIC.

Antimicrobial therapy is typically provided because these dogs are considered to be highly immunosuppressed with severe neutropenia and at risk of gastrointestinal translocation and secondary bacterial infections, such as sepsis, UTI, and pneumonia. Either ampicillin-sulbactam (30mg/kg IV TID) or ampicillin (22mg/kg IV TID) is a good choice for broad-spectrum coverage. Traditionally many clinicians have used additional antimicrobial therapy for enhanced Gram-negative spectrum, such as an aminoglycoside or fluoroquinolone, but these agents are often not warranted and should be used with caution due to the potential for adverse effects.

Antiemetic therapy is usually needed and can include metoclopramide (1-2mg/kg/day continuous rate infusion), maropitant (1mg/kg SQ q 24hrs), or ondansetron (0.2mg/kg IV BID); the ideal anti-emetic should be chosen based on the individual patient recognizing that only maropitant is labeled for use in dogs and each has potential adverse effects. Dogs should be encouraged to eat as soon as possible, as early enteral nutrition may result in further clinical improvement and improved outcome.

Many treatments have been tried in the past but have NOT been shown to be helpful and are therefore not currently recommended in the management of parvovirus, including steroids, antiendotoxin, and flunixin meglumide. Other treatments have had minimal research performed to date, and while not enough data yet exist to recommend adding these medications to our treatment protocols, the results are interesting and some may prove useful in the future pending further studies. The antiviral medication oseltamivir (Tamiflu) was tested in a randomized prospective trial on 35 dogs with parvovirus but no clear benefit was found of this therapy.
Immune-plasma taken from dogs surviving parvovirus enteritis was used in a prospective randomized double-blinded placebo-controlled clinical trial with 7 treated dogs and 7 control dogs (receiving 0.9% saline). No significant differences were identified between groups among neutrophil counts, magnitude of viremia, body weight change, length of hospitalization, or cost of treatment. Interferon-omega has been studied in beagles with clinical parvovirus and control beagles in a double-blinded placebo-controlled study, and in this study 4/5 treated dogs survived and 5/5 placebo dogs had progressive disease and passed away in 10 days. Unfortunately the placebo control group was treated with only subcutaneous fluids without antimicrobial or antiemetic therapy, likely explaining the low survival rate, which is considerably lower than expected and reported for dogs treated in most ICUs. Thus the results of this study and benefits of this medication warrant further investigation.

Recombinant human granulocyte-colony stimulating factor (G-CSF) has been evaluated in attempt to address the severe neutropenia that many puppies develop. In a randomized controlled clinical trial 23 puppies with parvovirus and <1000 neutrophils were enrolled and 11 of these puppies received the G-CSF daily until their neutrophils were >1500 while 12 control puppies did not receive the therapy; all puppies received standard supportive care. No significant differences were seen with regards to time of hospitalization or neutrophil counts between the treatment and control groups. A second G-CSF study enrolled 62 dogs with parvovirus and neutropenia (28 received recombinant canine G-CSF, 34 controls, and all 62 received supportive care). In this study the treated dogs had improved neutrophil counts and shorter hospitalization stays, but also shorter survival times with 4 treated dogs being euthanized or dying in the first week compared with no deaths in the control group within the first week. With these limited data, it cannot yet be recommended to administer G-CSF to clinical patients with parvovirus, but further research regarding efficacy, safety, and optimal dosing may be fruitful.

Monitoring and complications during hospitalization for parvovirus

Thorough physical exam including body weight should be performed at least twice daily (ideally more often) to assess hydration, so that changes in fluid administration can be made as needed. An estimate of fluid losses should be made including production of vomitus and diarrhea, to aid in calculation of fluid replacement requirements. Additional things to look for in the physical exam include crackles on thoracic auscultation suggestive of aspiration pneumonia, acute abdominal pain or a palpable mass suspicious for an intussusception, and evidence of intravenous catheter-site irritation/infection. Secondary infections including urinary tract infections and pneumonia are common because of the leukopenia and possibility of GI translocation of bacteria causing sepsis. Urinary tract infections may remain subclinical or silent, and are seen in up to 25% of parvovirus puppies; all attempts to keep these puppies clean should be made to minimize fecal contamination of their distal urethras. If concern exists for these infections, a urinalysis, urine culture, and/or chest radiographs should be performed as indicated. Blood glucose and blood smear to assess neutrophil count should be monitored at least daily throughout hospitalization as well, and if puppies are not improving as expected, a full CBC and chemistry (+/- coagulation profile) are recommended to reevaluate their status (white cell differential, proteins, electrolytes, glucose, organ function, etc.). Rarely, infected dogs may develop neurologic signs from the virus itself, or more likely from electrolyte imbalances, hypoglycemia, sepsis, or from disseminated intravascular coagulopathy causing hemorrhage into the central nervous system, underscoring the need for close monitoring with physical exams and laboratory work.

Prevention of parvovirus

No discussion regarding management of parvovirus would be complete without mention of the importance of vaccinating our canine patients. Vaccination is critical for the prevention of parvovirus. Developing a hospital protocol for vaccination and educating clients about the benefit of vaccination versus the severity of parvoviral enteritis is advised. Clients should be taught about the window of susceptibility for their puppy to develop parvovirus, and the importance of keeping them isolated from potential exposure during this vulnerable time. Although puppies are at highest risk, clients should be educated that unvaccinated adult dogs too can become infected and ill from parvovirus, and that vaccination is important in these dogs as well. Currently available vaccines have been demonstrated in prospective studies to offer cross-protection against both CPV-2b and CPV-2c variants. In order to provide full protection and to avoid perceived vaccine breaks, vaccines should be administered by veterinarians, so that proper schedules, storage, and administration can be strictly followed.

Selected references