Septic Peritonitis: An Overview in Dogs and Cats

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Septic peritonitis (SP) is a life threatening condition that requires immediate surgical intervention. Diagnosis of SP is made by finding intracellular bacteria in the peritoneal effusion and is supported by increased lactate and decreased glucose concentrations compared to serum. Survival rates for dogs with SP are reported to be between 29 and 71%. Survival rates for cats range from 46-70%.

The most commonly reported cause of SP in dogs and cats is gastrointestinal (GI) perforation. Neoplasia and trauma are the most common causes of GI perforation in cats, however, cats have also been reported to develop primary SP, where a cause is not identified during exploratory laparotomy. These infections have been classified as mostly monomicrobial in one report and polymicrobial in another. In both reports 60% of the bacteria that was cultured were gram positive. In dogs perforation secondary to foreign bodies are the most common causes, followed by neoplasia.

In humans, SP is divided into three categories. Primary SP is an infection of the abdominal cavity with no identifiable cause from an abdominal organ or penetrating injury. It has been identified in children and adults suffering from post-necrotic cirrhosis, nephrotic syndrome, alcoholic cirrhosis, congestive heart failure, malignant metastatic neoplasia, systemic lupus erythematosus, and lymphedema. The route of infection is most commonly hematogenous, with some lymphogenous and transmural translocation from the gastrointestinal or reproductive tracts. Secondary SP is due to perforation of an abdominal organ, presence of an abscess, and penetrating trauma. In human and veterinary medicine, standard of care is surgical management. Development of secondary SP in human medicine is associated with a mortality of 30%. The presence of septic shock and development of secondary organ failure has an associated mortality of 60%. Lastly, tertiary SP is the presence of persistent signs of sepsis and peritonitis despite surgical treatment of secondary peritonitis. Identification of SP in humans is accompanied by the presence of clinical signs and the use of a spiral and multidetector-slice CT which can show source of leakage in 97.2% of patients.

Several prognostic indicators for survival have been identified in dogs. Increased survival was documented in dogs with a Protein C activity of more than 60% and antithrombin activity of more than 41.5% at presentation. Improved survival has also been documented with higher initial blood pressures and higher albumin concentrations. Plasma lactate concentrations of >4 mmol/L at admission and inability to normalize lactate concentrations within 6 hours of
admission are consistent with non-survival in dogs. Ionized hypocalcemia has also been
documented in dogs with sepsis. It has not been associated with survival, but has been associated
with longer hospitalization time. Treatment protocols such as appropriate empirical antibiotic
choice, length of surgery, use of open peritoneal drainage post operatively have not been shown
to improve survival in dogs.

Less is known in cats with critical illness than what has been reported in dogs. A small
number of studies have documented the impact of several individual clinicopathologic
measurements. A study investigating ionized hypocalcemia at presentation in cats with SP did
not show an impact on survival, but failure to normalize hypocalcemia during hospital stay was
associated with decreased survival. Ionized hypocalcemia in that study was also associated with
increased length of hospitalization and increased duration of ICU stay.

Lactate as a marker of anaerobic metabolism has also been evaluated in cats with SP and
an association with increased mortality has been documented in that species. However, no other
prognostic indicators have been identified in cats with SP when looking at intake physical exam,
complete blood count, and biochemical analysis.

There are a few reports attempting to identify prognostic indicators in cats with severe
critical illness. Several factors such as hypoalbuminemia (< 2.7 g/dL) and hyperbilirubinemia
(>1.0 g/dL) was consistent found critically ill cats but was not associated with increased
mortality. Critically ill cats have an increase in morbidity when admission systemic blood
pressure is < 90 mmHg. Concurrent intake hypothermia and lower intake PCV in patients with
hypotension has also been associated with increased mortality. Lastly, cats with sepsis have been
shown to have higher concentration of bands and a lower albumin concentration when compared
to cats with SIRS.

**Retrospective study evaluating septic peritonitis in cats at initial presentation.**
This study spans 2 academic institutions (Texas A&M and UC Davis). We will be adding
animals from Michigan State University. Current study has 44 cats with an overall survival rate
of 65.9% (29/44). Sixteen cats had primary SP, 28 cats had secondary SP, and 2 cats had tertiary
SP. Our study identified a clear distinction in the isolates obtained from cats with primary,
secondary and tertiary SP. Cats with primary and secondary had a similar number of
monomicrobial infections, while cats with tertiary only had monomicrobial infections. Primary
SP cats were more likely to have a higher percentage of gram positive bacteria. Bacterial
translocation from the gastrointestinal tract is a potential cause of primary SP due to the natural
presence of gram positive bacteria within the cat intestines such as Clostridium and Enterococcus
species. Patients with secondary SP were more likely to have mixed gram-positive and gram-
negative infections. This is likely to due the fact that many of the infections were from
gastrointestinal leakage which harbors both gram positive and gram negative bacteria. The two
cats with tertiary SP had strictly gram-positive infections. Based on the isolates in these two cats
(Enterococcus and Clostridium), a hematogenous spread from the gastrointestinal tract may be
the most likely explanation for the abdominal infection, as these patients had no intraoperative evidence of dehiscence.

The most commonly isolated bacterial organisms found in all three SP included Clostridium, Enterococcus and Escherichia coli. This is consistent with previous reports of SP in both cats and dogs. In the present study we did not find that the use of inappropriate selection of empirical antimicrobials was associated with increased mortality in cats. Current recommended protocol for cats and dogs with SP promotes the use of ampicillin-sulbactam and a fluoroquinolone. This will provide appropriate coverage for gram-negative bacteria, streptococci, enterococcus, and most anaerobes which would be an appropriate choice for patients in this population.

Our study showed no difference in survival between patients with hypothermia (37.3C, 99.5 F) or hyperthermia (39.5 C, 103.1 F). Absolute hyperlactatemia (>2.0 ug/dL) did not have statistically significant impact on prognosis, however, survivors did have a lower median lactate concentration (2.5 ug/dL) than non-survivors (6.1 ug/dL). Lactate is a metabolic byproduct of ATP production during anaerobic metabolism and increases in states of low oxygen tension (Type A lactic acidosis), organ derangements (Type B lactic acidosis), or cellular dysfunction (Type C lactic acidosis).