



Septic Shock

Basics

OVERVIEW

- Shock associated with generalized bacterial infection (generalized bacterial infection known as “sepsis”; condition known as “septic shock”)
- Develops as a complication of overwhelming generalized (systemic) infection
- Septic shock is associated with low blood flow (known as “hypoperfusion”) or low blood pressure (known as “hypotension”) that may or may not respond to fluids or medical treatment to maintain arterial blood pressure

SIGNALMENT/DESCRIPTION OF PET

Species

- Dogs
- Cats

SIGNS/OBSERVED CHANGES IN THE PET

- Possible history of recent infection (such as urinary tract infection [UTI] or infection/inflammation of the prostate [known as “prostatitis”]), injury, or surgery
- Signs from other conditions or treatments that potentially decrease the immune response (known as “immunosuppressive” conditions or treatments), such as diabetes mellitus (“sugar diabetes”); increased levels of steroids produced by the adrenal glands (known as “hyperadrenocorticism” or “Cushing's syndrome”), or chemotherapy regimens

Early Shock

- Sluggishness (lethargy) and weakness
- Rapid heart rate (known as “tachycardia”)
- Normal or high arterial blood pressure
- Bounding pulses
- The pink or red color of the gums is slow to return when the gums are blanched by finger pressure (known as “decreased capillary refill time”)
- Fever
- Rapid breathing (known as “tachypnea”)
- Cats rarely demonstrate these signs

Late Shock

- Slow heart rate (known as “bradycardia”)
- Poor pulses
- Pale gums or moist tissues of the body (known as “mucous membranes”)
- The pink color of the gums is very slow to return when the gums are blanched by finger pressure (known as

“prolonged capillary refill time”)

- Cool extremities
- Low body temperature (known as “hypothermia”)
- Mental depression or stupor
- Difficulty breathing (known as “dyspnea”); rapid breathing (tachypnea)
- Extreme weakness or collapse

CAUSES

- Compromise of the lining of the gastrointestinal tract, resulting in bacteria moving from the intestinal tract into the body and causing bacterial toxins to accumulate in the blood (known as “endotoxemia”)
- Urinary tract infection
- Infection/inflammation of the prostate (prostatitis) and abscesses of the prostate
- Inflammation with accumulation of pus in the uterus (known as “pyometra”)
- Inflammation secondary to infection of the joints (known as “septic arthritis”)
- Infection/inflammation of the bone marrow and bone (known as “osteomyelitis”)
- Gastrointestinal rupture
- Bacterial infection of the lining of the abdomen (known as “septic peritonitis”)
- Pneumonia
- Bacterial infection of the lining of the heart (known as “bacterial endocarditis”)
- Bite wounds
- Bacterial infection and inflammation of the membranes covering the brain and spinal cord (condition known as “meningitis”) and infection and inflammation of the brain (known as “encephalitis”)
- Other sources of possible infection—catheters, surgical implants

RISK FACTORS

- Extremes of age (that is, very young or very old)
- Coexistent condition or treatment causing decrease in the immune response (known as “immunosuppression”) and increasing likelihood of development of generalized bacterial infection (sepsis); conditions include such diseases as diabetes mellitus (“sugar diabetes”); increased levels of steroids produced by the adrenal glands (hyperadrenocorticism or Cushing's syndrome); cancer; and heart and lung disease
- Decrease in the immune response (immunosuppression) due to low white-blood cell counts (known as “neutropenia”) or medications (such as steroids or chemotherapy drugs)
- Major surgery, trauma, or burns
- Prior antibiotic treatment

Treatment

HEALTH CARE

- Emergency intensive care
- Medical management to correct low levels of oxygen in the blood (known as “hypoxia”), low blood pressure (hypotension), and decreased oxygen levels in the tissues
- Identify and treat the source of the infection (using antibiotics, surgery, or both)
- Fluid therapy is needed; the volume of fluids needed and the rate of administration is based on evaluation of the pet's status as well as close monitoring; crystalloids are fluids that contain electrolytes (chemical compounds, such as sodium, potassium, chloride) necessary for the body to function, crystalloids generally are similar to the fluid content (plasma) of the blood and move easily between the blood and body tissues, example is lactated Ringer's solution; colloids are fluids that contain larger molecules that stay within the circulating blood to help maintain circulating blood volume, examples are dextran and hetastarch
- Oxygen supplementation—as important as fluid replacement; administer by oxygen cage, mask, or nasal cannula
- Blood-containing products (such as packed red blood cells or plasma) may be necessary, based on assessment of the pet's condition

DIET

- No food or water by mouth

SURGERY

- Surgically remove any source of generalized bacterial infection (sepsis), such as an abscess; aggressive treatment and life support may be required

Medications

Medications presented in this section are intended to provide general information about possible treatment. The treatment for a particular condition may evolve as medical advances are made; therefore, the medications should not be considered as all inclusive.

- Systemic blood pressure may be raised through the use of medications that improve heart muscle contraction (known as “positive inotropes,” such as dobutamine) or medications to constrict blood vessels to increase blood pressure (known as “vasopressors,” such as dopamine, vasopressin, or norepinephrine)
- Broad-spectrum antibiotics administered intravenously are essential while awaiting results of blood, urine, or tissue bacterial cultures; antibiotic selection should be adjusted once bacterial culture and sensitivity results are available
- Steroids (intravenous hydrocortisone) may be necessary in pets that do not respond to treatment

Follow-Up Care

PATIENT MONITORING

- Heart rate, pulse intensity, color of gums and moist tissues (mucous membrane), breathing rate, lung sounds, urine output, mental status; and rectal temperature during treatment
- Monitor fluid therapy carefully
- Electrocardiogram (ECG, a recording of the electrical activity of the heart) and blood pressure measurement are useful; use blood-gas analysis (measurements of oxygen and carbon dioxide levels in arterial blood) and pulse oximetry (a means of measuring oxygen levels in blood), to monitor tissue oxygen levels
- Blood work (such as packed cell volume [PCV, a means of measuring the percentage volume of red blood cells as compared to the fluid volume of blood]; serum total protein [a quick laboratory test that provides general information on the level of protein in the fluid portion of the blood]; blood glucose; serum electrolytes; liver enzymes; blood urea nitrogen; and serum creatinine)

PREVENTIONS AND AVOIDANCE

- Timely and effective treatment of wounds
- Appropriate use of antibiotics

POSSIBLE COMPLICATIONS

- Fluid buildup in the lungs (known as “pulmonary edema”) Inflammation of blood vessels (known as “vasculitis”)
- Low levels of glucose or sugar in the blood (known as “hypoglycemia”)
- Low levels of red blood cells (known as “anemia”) or platelets (known as “thrombocytopenia”); “platelets” and “thrombocytes” are names for the normal cell fragments that originate in the bone marrow and travel in the blood as it circulates through the body; platelets act to “plug” tears in the blood vessels and to stop bleeding
- Abnormal blood clotting (known as “coagulopathy”)
- Multiple organ dysfunction (heart, lungs, kidneys, liver, gastrointestinal tract, pancreas, adrenal glands, or brain)
- Cardiac arrest
- Death

EXPECTED COURSE AND PROGNOSIS

- Depend on underlying cause
- Septic shock is a life-threatening condition

Key Points

- Septic shock is a life-threatening condition
- Septic shock is associated with low blood flow (hypoperfusion) or low blood pressure (hypotension) that may or may not respond to fluids or medical treatment to maintain arterial blood pressure

- Fluid therapy is needed; the volume of fluids needed and the rate of administration is based on evaluation of the pet's status as well as close monitoring
- Oxygen supplementation—as important as fluid replacement
- Broad-spectrum antibiotics administered intravenously are essential
- Aggressive treatment and life support may be required

Notes

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