



Inflammation/Infection of the Lining of the Heart, Usually Involving the Heart Valves (Infective Endocarditis)

Basics

OVERVIEW

- “Infective endocarditis” is inflammation and infection of the lining of the heart, usually involving the heart valves
- “Infective” is the medical term for agents that are capable of causing disease or infection; “endo-” refers to “inside” or “within” and “carditis” is the medical term for inflammation of the heart
- The heart of the dog or cat is composed of four chambers; the top two chambers are the right and left atria and the bottom two chambers are the right and left ventricles; heart valves are located between the right atrium and the right ventricle (tricuspid valve); between the left atrium and the left ventricle (mitral valve); from the right ventricle to the main pulmonary (lung) artery (pulmonary valve); and from the left ventricle to the aorta (the main artery of the body; valve is the aortic valve)
- Infectious agents usually are gram-positive bacteria, especially staphylococci or streptococci; occasionally *Rickettsia* or *Bartonella* in dogs
- Infectious agents rarely are fungi in dogs; cases that have negative bacterial culture results may have infection by *Bartonella* or *Aspergillus*, a type of fungus; less likely is infection by *Brucella*, *Coxiella*, and *Chlamydia*

GENETICS

- Genetic susceptibility is unlikely

SIGNALMENT/DESCRIPTION OF PET

Species

- Dogs
- Cats—rare

Breed Predispositions

- Middle-sized to large-breed dogs
- Breeds susceptible to a birth defect involving narrowing just below the aortic valve, the heart valve from the left

ventricle to the aorta (the main artery of the body; condition known as “subaortic stenosis”)

Mean Age and Range

- Most affected dogs are 4–8 years of age; infection can occur at any age

Predominant Sex

- Most studies report males are more likely to be affected than females—may be as great as a 2:1 ratio of males-to-females

SIGNS/OBSERVED CHANGES IN THE PET

- The presence of gram-negative bacteria in the blood (known as “gram-negative bacteremia”) results in very sudden (known as “peracute”) or sudden (known as “acute”) clinical signs; the presence of gram-positive bacteria in the blood (known as “gram-positive bacteremia”) results in signs over a moderate amount of time (known as “subacute”) or long-term (known as “chronic”)
- Generalized (systemic) signs are secondary to sudden lack of blood supply that leads to death of tissues (known as “infarction”), inflammation, infection, presence of bacterial toxins in the blood (known as “toxemia”), or damage due to the body’s immune response; usually override heart signs (such as congestive heart failure [CHF] and/or irregular heartbeats [arrhythmias]); congestive heart failure is a condition in which the heart cannot pump an adequate volume of blood to meet the body’s needs—CHF signs include cough; difficulty breathing (known as “dyspnea”); bluish discoloration of the skin and moist tissues (mucous membranes) of the body caused by inadequate oxygen levels in the red blood cells (known as “cyanosis”)
- May have had signs of infectious disease involving the skin, mouth, gastrointestinal tract, and/or genital tract (such as inflammation/infection of the prostate [known as “prostatitis”]) within the past few weeks to several months in some pets
- The pet may have signs of other diseases and/or history of factors that increase the likelihood of infection of the lining of the heart, such as being on medications to decrease the immune response (known as “immunosuppressive drug therapy”), narrowing of the aortic valve, the heart valve from the left ventricle to the aorta (the main artery of the body; condition known as “aortic stenosis”), recent surgery, infected wounds, abscesses, or skin infection characterized by the presence of pus (known as “pyoderma”)
- Sluggishness (lethargy)
- Weakness and/or lameness
- Fever
- Lack of appetite (known as “anorexia”)
- Stomach and/or intestinal disturbances
- General signs of discomfort and “not feeling well” (known as “malaise”)
- Difficulty breathing (dyspnea) caused by congestive heart failure; “congestive heart failure” is a condition in which the heart cannot pump an adequate volume of blood to meet the body’s needs
- Irregular heartbeats (arrhythmias)
- Single or shifting-leg lameness; “shifting-leg” lameness is characterized by lameness in one leg, then that leg appears to be normal and another leg is involved
- Heart murmur

CAUSES

- Bacterial infection associated with the mouth, bone, prostate, skin, and other sites
- Diagnostic or surgical procedures that may lead to introduction of bacteria into the bloodstream

RISK FACTORS

- Congenital (present at birth) heart defect involving narrowing just below the aortic valve, the heart valve from the left ventricle to the aorta (the main artery of the body; condition is “subaortic stenosis”)
- Decreased ability to produce a normal immune response (known as “immunosuppression”) from treatment with long-term or high-dose steroids or secondary to cancer or administration of chemotherapy

Treatment

HEALTH CARE

- Virtually all pets with suspected inflammation/infection of the lining of the heart, usually involving the heart

valves (infective endocarditis) should be hospitalized

- Good hydration for pets with generalized bacterial infection (known as “septic patients”), particularly those receiving a particular class of antibiotics (known as an “aminoglycoside”)
- Aggressive fluid therapy—especially for pets with kidney failure
- Actual or impending (that is, about to occur) congestive heart failure limits fluid volumes that can be administered; this problem is virtually insurmountable in pets with coexistent kidney failure; congestive heart failure is a condition in which the heart cannot pump an adequate volume of blood to meet the body’s needs
- Impending (that is, about to occur) CHF—cautious use of fluid therapy

ACTIVITY

- Variable restriction—depends on whether or not congestive heart failure is present or impending (that is, about to occur)

DIET

- Moderate sodium restriction if congestive heart failure is present or impending (that is, about to occur)

SURGERY

- Inflammation/infection of the aortic valve (aortic valve endocarditis)—almost always results in left-sided congestive heart failure that is difficult to control medically; congestive heart failure is a condition in which the heart cannot pump an adequate volume of blood to meet the body’s needs; surgery to replace the aortic valve is indicated—this surgical procedure routinely is performed in human medicine, but rarely attempted in veterinary medicine because of lack of expertise, lack of facilities, and high cost

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

- Treatment is variable—depends on severity of generalized bacterial infection (sepsis) and presence or absence of congestive heart failure; congestive heart failure is a condition in which the heart cannot pump an adequate volume of blood to meet the body’s needs

ANTIBIOTICS

- Backbone of treatment, but usually don’t eradicate infection before irreversible aortic-valve damage occurs; more than minimal damage to the aortic valve is life-threatening
- High-dose, intravenous (IV) administration of antibiotics designed to kill bacteria (known as “bactericidal antibiotics”) is imperative and recommended for as long as feasible, followed by subcutaneous (SC or under the skin) administration
- Antibiotics administered by mouth—recommended only after at least 4 weeks of injectable therapy and at least 1 week after blood work changes and clinical signs of inflammation and infection have disappeared; long-term (greater than 4 months) treatment required to eradicate the infection from abnormal or damaged heart valves
- Continue antibiotic treatment for 1 year
- Antibiotic selection determined by both the urgency of complications of the generalized bacterial infection (sepsis) and results of bacterial culture; coagulase-positive staphylococci and streptococci are incriminated most often as causing the disease, so choices of antibiotics can be made logically before bacterial culture results are obtained
- Coagulase-positive staphylococci—usually resistant to penicillin and ampicillin
- Streptococci—often resistant to aminoglycosides and fluoroquinolones
- Gram-negative bacteria—often sensitive to third-generation cephalosporins, fluoroquinolones, and aminoglycosides
- *Bartonella*—only aminoglycosides appear bactericidal; can try doxycycline, fluoroquinolone, rifampin, or azithromycin
- First-generation cephalosporins—reasonable choice for stable pets until bacterial culture results are obtained
- Treat life-threatening, generalized bacterial infection (sepsis) immediately with drug combinations; pending bacterial culture results, one of three regimens is recommended: (1) penicillin, ampicillin, ticarcillin, or a first-

generation cephalosporin combined with an aminoglycoside—high doses of aminoglycosides cannot be administered, and fluid support with monitoring for kidney toxicity (side effect of aminoglycosides) is required; thus aminoglycosides are not good choices for pets with overt or impending (that is, about to occur) congestive heart failure or those with kidney failure; (2) clindamycin plus enrofloxacin; (3) advanced-generation cephalosporins or ticarcillin-clavulanic acid (Timentin)—high dosages, but only normal dosages if the pet has kidney failure

TREATMENT OF CONGESTIVE HEART FAILURE

- Various heart medications (such as pimobendan, angiotensin converting enzyme [ACE] inhibitors, and amlodipine) and medications to remove excess fluid from the body (known as “diuretics,” such as furosemide and spironolactone) are indicated for pets with congestive heart failure; congestive heart failure is a condition in which the heart cannot pump an adequate volume of blood to meet the body’s needs
- Oxygen, nitroglycerin, high-dose furosemide, and hydralazine for pets with sudden (acute), severe fluid buildup in the lungs (known as “pulmonary edema”)
- “Blood thinners” or medications to prevent the development of blood clots (known as “anticoagulant therapy”) may be used
- Aspirin and/or dalteparin may reduce the spread of the bacteria and prevent the development of blood clots
- Heparin can be used in the hospital setting to decrease the likelihood of blood-clot formation

Follow-Up Care

PATIENT MONITORING

- Emergence of antibiotic resistance—relapsing fever and changes in the white-blood cell count indicating inflammation; imperative to adjust treatment on the basis of bacterial culture results
- Frequent physical examinations and complete blood counts (CBCs) after discharge
- Repeat blood cultures 1 week after antibiotics are discontinued or if fever recurs

PREVENTIONS AND AVOIDANCE

- Indwelling catheters—restrict to appropriate usage; place intravenous catheter into vein using sterile technique (known as “aseptic placement”); replace IV catheter within 3–5 days
- Administer antibiotics to dogs with subaortic stenosis during dentistry—“subaortic stenosis” is a birth defect involving narrowing just below the aortic valve, the heart valve from the left ventricle to the aorta (the main artery of the body)
- Avoid careless use of steroids

POSSIBLE COMPLICATIONS

- Congestive heart failure, condition in which the heart cannot pump an adequate volume of blood to meet the body’s needs
- Kidney failure
- Presence of infected blood clots in many tissues and organs
- Persistent or dormant diseases of several joints caused by an immune response (known as “immune-mediated polyarthropathy”)

EXPECTED COURSE AND PROGNOSIS

- Best prognosis associated with short history of bacteria in the blood (bacteremia), rapid diagnosis, and aggressive treatment
- Death rate relatively higher in affected pets recently given steroids
- Grave prognosis for pets with inflammation/infection of the aortic valve (aortic valve endocarditis); the aortic valve is the valve from the left ventricle to the aorta (the main artery of the body)
- Guarded prognosis for pets with inflammation/infection of the mitral valve (mitral valve endocarditis); however, they can be saved with appropriate treatment
- Dormant congestive heart failure can occur with advanced inflammation/infection of the mitral valve (mitral valve endocarditis), late diagnosis, or inadequate treatment for mitral valve endocarditis; the mitral valve is the heart valve between the left atrium and the left ventricle

Key Points

- Infective endocarditis is inflammation and infection of the lining of the heart, usually involving the heart valves
- Grave prognosis if the aortic valve is involved; the aortic valve is the valve from the left ventricle to the aorta (the main artery of the body)
- Guarded prognosis if only the mitral valve is involved; however, with relatively early diagnosis and aggressive treatment, survival is likely; the mitral valve is the heart valve between the left atrium and the left ventricle

Notes

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