LEFT-SIDED CONGESTIVE HEART FAILURE

BASICS

OVERVIEW

• Failure of the left side of the heart to pump blood at a sufficient rate to meet the needs of the body or to prevent blood from pooling within the veins of the lungs
• 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)
• The "left side" of the heart consists of the left atrium and the left ventricle

GENETICS

• Some congenital (present at birth) heart defects, heart-muscle diseases (known as "cardiomyopathies"), and heart valve diseases have a genetic basis in some breeds

SIGNALMENT/DESCRIPTION of ANIMAL

Species

• Dogs and cats

Breed Predilections

• Vary with cause

Mean Age and Range

• Vary with cause

Predominant Sex

• Varies with cause

SIGNS/OBSERVED CHANGES in the ANIMAL

• Signs vary with underlying cause
• Signs vary with the species involved
• Weakness, sluggishness (lethargy), exercise intolerance
• Coughing (dogs) and difficulty breathing (known as "dyspnea"); breathing signs often worsen at night and can be relieved by assuming a standing position, lying on the chest bone (known as "sternal recumbency"), or standing with the elbows away from the body in an attempt to increase lung capacity (known as "orthopnea")
• Cats rarely cough from heart failure
• Rapid breathing (known as "tachypnea")
• Coughing, often soft in conjunction with rapid breathing (tachypnea) in dogs
• Abnormal breath sounds on listening to the lungs with a stethoscope (known as "auscultation")—short, rough snapping sounds (known as "crackles"); and squeaking or whistling sounds (known as "wheezes")
• Pale/gray/bluish (known as "cyanotic") gums and moist tissues of the mouth (known as "mucous membranes")
• Pink color of the gums is slow to return when the gums are blanched by finger pressure (known as "prolonged capillary refill time")
• Possible heart murmur or gallop rhythm heard when listening to the heart with a stethoscope
• Weak femoral pulses

CAUSES

Pump (Muscle) Failure of the Left Ventricle

• Heart muscle is flabby and weak for unknown causes (so called "idiopathic dilated cardiomyopathy" or "DCM")
• Trypanosomiasis (disease caused by the protozoa, *Trypanosoma*)—rare
• Toxicity of doxorubicin (a chemotherapeutic drug) to the heart in dogs
• Inadequate levels of thyroid hormone (known as "hypothyroidism")—rare
• Excessive levels of thyroid hormone (known as "hyperthyroidism")—rarely causes pump failure

Pressure Overload of the Left Side of the Heart

• Generalized (systemic) high blood pressure (known as "hypertension")
• 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")
• Narrowing of the aorta (known as "coarctation of the aorta")—rare; Airedale terriers more likely than other breeds to have this condition
• Tumors of the left ventricle—rare

Volume Overload of the Left Side of the Heart

• Long-term (chronic) mitral valve disease (known as "endocardiosis")—dogs; the "mitral valve" is the heart valve between the left atrium and the left ventricle
• Abnormal development of the mitral valve (known as "mitral valve dysplasia")—cats and dogs; the "mitral valve" is the heart valve between the left atrium and the left ventricle
• Developmental abnormalities or birth defects involving the heart (such as patent ductus arteriosus or PDA in dogs and ventricular septal defect in dogs and cats)
• Backward flow of blood through the aortic valve (known as "aortic valve insufficiency") secondary to infection/inflammation of the lining of the heart (known as "endocarditis")—dogs; the "aortic valve" is the valve from the left ventricle to the aorta (the main artery of the body)

Impediment to Filling of the Left Side of the Heart

• Fluid build-up between the heart and the sac surrounding the heart (known as "pericardial effusion") with resulting compression of the heart (known as "tamponade")
• Inflammation of the sac surrounding the heart (pericardium) with thickening and scarring, such that it restricts filling of the heart with blood as the ventricles cannot expand normally (known as "constrictive pericarditis" or "restrictive pericarditis")
• Heart-muscle disease in which the muscle is "stiff" and does not expand, such that blood cannot fill the ventricles normally (known as "restrictive cardiomyopathy")
• Disease characterized by inappropriate enlargement or thickening of the heart muscle of the left ventricle (known as "hypertrophic cardiomyopathy" or "HCM")
• Masses (such as a tumor or blood clot [known as a "thrombus"]) in the left atrium
• Blood clots in the lungs (known as "pulmonary thromboembolism")
• Narrowing of the mitral valve (known as "mitral stenosis")—rare; the "mitral valve" is the heart valve between the left atrium and the left ventricle

Heart Rate or Rhythm Disturbances

• Slow heart rate (known as "bradycardia")
• Rapid heart rate (known as "tachycardia")

RISK FACTORS

• Conditions causing long-term (chronic), high blood volume being pumped by the heart (known as "high cardiac output"), such as excessive levels of thyroid hormone (hyperthyroidism), low red-blood cell count (known as "anemia"), and pregnancy

TREATMENT

HEALTH CARE

• Usually treat as outpatient, unless animal is having difficulty breathing (dyspnea) or has very low blood pressure (known as "severe hypotension")
• Identify and correct underlying cause whenever possible
• Minimize handling of animals that are having critical breathing difficulties (critical dyspnea)—stress can kill!
• Oxygen is life saving in animals that are having critical breathing difficulties (critical dyspnea)

ACTIVITY

• Restrict activity

DIET

• Initiate moderately sodium-restricted diet
• Severe sodium restriction is indicated in animals with advanced disease

SURGERY

• Surgery may benefit selected patients with congenital (present at birth) defects, such as patent ductus arteriosus (PDA), and some forms of heart valve disease; response to surgery varies
• Tapping and draining the space between the heart and the sac surrounding the heart (pericardium; procedure known as "pericardiocentesis") in animals with fluid build-up (pericardial effusion)

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.

Medications to Remove Excess Fluid from the Body (known as "Diuretics")

• Furosemide or another "loop diuretic" is the initial diuretic of choice; diuretics are indicated to remove fluid build-up from the lungs (known as "pulmonary edema"); animals that are having critical breathing difficulties (critical dyspnea) often require high doses given intravenously to stabilize them; once the fluid build-up in the lungs resolves, the dose gradually should be reduced to the lowest effective dosage, as directed by your pet's veterinarian

• Spironolactone increases survival in people with heart failure because of its ability to block aldosterone (a hormone produced by the adrenal gland; involved in sodium and potassium regulation in the body); use in combination with furosemide
• Thiazide diuretics can be added to furosemide and spironolactone in heart failure cases that do not respond to these medications

Digoxin (Type of Heart Medication)

• Digoxin is used in animals with heart-muscle failure (such as dilated cardiomyopathy, a disease characterized by a flabby, weak heart muscle)
• Digoxin also is indicated to treat certain abnormal or irregular heart rhythms that start in heart tissue above the ventricles (known as "supraventricular arrhythmias") in patients with congestive heart failure
• In people, digoxin has no effect on mortality, but decreases hospitalization due to heart failure

Medications to Enlarge or Dilate the Veins (known as "Venodilators")

• Nitroglycerin ointment causes dilation of the veins, thus lowering the pressure required to fill the left atrium
• Used for immediate stabilization of patients with severe fluid build-up in their lungs (pulmonary edema) and difficulty breathing (dyspnea)
• May be useful in animals with long-term (chronic) left-sided congestive heart failure; to avoid tolerance to the drug, use intermittently and with 12-hour dose-free interval between the last dose of one day and the first dose of the next day

Angiotensin-Converting Enzyme (ACE) Inhibitors (Type of Heart Medication)

• Angiotensin-converting enzyme (ACE) inhibitor, such as enalapril or benazepril, is indicated in most animals with left-sided congestive heart failure
• ACE inhibitors improve survival and quality of life in dogs with left-sided congestive heart failure secondary to degenerative valve disease and dilated cardiomyopathy (disease characterized by a flabby, weak heart muscle)

Medications that Improve Heart-Muscle Contraction (known as "Positive Inotropes")

• Dobutamine is a potent medication that improves heart-muscle contraction (positive inotropic agent) and may provide valuable short-term support of a heart failure patient with poor heart-muscle contractility
• Pimobendan is a calcium-channel sensitizer that dilates arteries and increases heart-muscle contraction—first line medication in treating dilated cardiomyopathy (disease characterized by a flabby, weak heart muscle); useful in dogs with congestive heart failure due to long-term (chronic) heart valve disease that does not respond to medical treatment
• Positive inotropes can cause irregular heart beats; careful monitoring is required

Medications to Control Irregular Heart Beats (known as "Antiarrhythmic Agents")

• Treat irregular heart beats (known as "arrhythmias"), as needed

Medications to Enlarge or Dilate Arteries (known as "Arterial Dilators")

• Hydralazine or amlodipine can be substituted for an angiotensin-converting enzyme (ACE) inhibitor in patients that do not tolerate the drug or have advanced kidney failure; monitor for low blood pressure (hypotension) and rapid heart rate (tachycardia); can be added to an angiotensin-converting enzyme (ACE) inhibitor cautiously in animal with left-sided congestive heart failure that does not respond to medical treatment
• Nitroprusside is a potent medication that dilates arteries (arterial dilator); it usually is reserved for short-term support of patients with life-threatening fluid build-up in their lungs (pulmonary edema)

Calcium Channel Blockers

• Diltiazem frequently is used in patients with left-sided congestive heart failure for heart rate control in animals with abnormal or irregular heart rhythms that start in heart tissue above the ventricles (supraventricular arrhythmias) not controlled by digoxin and in cats with hypertrophic cardiomyopathy (disease characterized by inappropriate enlargement or thickening of the heart muscle of the left ventricle)

Beta Blockers

• Atenolol and metoprolol are used for heart rate control in animals with rapid heart rhythms that start in heart tissue above the ventricles (known as "supraventricular tachycardia"), hypertrophic cardiomyopathy (disease characterized by inappropriate enlargement or thickening of the heart muscle of the left ventricle), and excessive levels of thyroid hormone (hyperthyroidism)
• Used alone or with a medication to control irregular ventricular heart beats (antiarrhythmic drug); these drugs depress heart-muscle contraction (known as "negative inotropes"), so they should be used cautiously in patients with heart-muscle failure
• On basis of human studies, may enhance survival in animals with idiopathic dilated cardiomyopathy (disease characterized by a flabby, weak heart muscle of unknown cause)

Nutritional Supplements

• Potassium supplementation, if low levels of potassium in the blood (known as "hypokalemia") are documented; use potassium supplements cautiously in animals receiving an angiotensin-converting enzyme (ACE) inhibitor or spironolactone
• Taurine supplementation in cats with dilated cardiomyopathy (disease characterized by a flabby, weak heart muscle) and dogs with dilated cardiomyopathy and taurine deficiency (such as American cocker spaniels); taurine is an amino acid (protein) that is an important component of the diet of cats; cats cannot produce enough taurine in their bodies and so, must obtain taurine from their food to maintain the health of several organs, including the heart; dogs may be affected by inadequate levels of taurine as well
• L-carnitine supplementation may help some dogs with dilated cardiomyopathy (disease characterized by a flabby, weak heart muscle)

• Coenzyme Q_{10} is of potential value based on the results of small trials in people with dilated cardiomyopathy (disease characterized by a flabby, weak heart muscle)

FOLLOW-UP CARE

PATIENT MONITORING

• Monitor kidney status, electrolytes, hydration, breathing rate and effort, heart rate, body weight, and abdominal girth (dogs)
• If excess levels of urea and other nitrogenous waste products in the blood (known as "uremia" or "azotemia") develop, reduce the dosage of diuretic, as directed by your pet's veterinarian; if azotemia persists and the animal also is on an angiotensin-converting enzyme (ACE) inhibitor, reduce or discontinue the ACE inhibitor, as directed by your pet's veterinarian
• Use digoxin with caution if excess levels of urea and other nitrogenous waste products in the blood (azotemia) develop
• Monitor electrocardiogram ("ECG," a recording of the electrical activity of the heart) if irregular heart beats (arrhythmias) are suspected
• Check digoxin concentration in the blood periodically

PREVENTIONS AND AVOIDANCE

• Minimize stress, exercise, and sodium intake in patients with heart disease
• Use of an angiotensin-converting enzyme (ACE) inhibitor early in the course of heart disease in patients with dilated cardiomyopathy (disease characterized by a flabby, weak heart muscle) may slow the progression of heart disease and delay onset of congestive heart failure
• Use of an angiotensin-converting enzyme (ACE) inhibitor in animals with mitral valve disease that are not showing signs of disease remains controversial

POSSIBLE COMPLICATIONS

• Fainting (known as "syncope")
• Blood clots in the aorta, the main artery of the body (known as "aortic thromboembolism") in cats
• Irregular heart beats (arrhythmias)
• Electrolyte imbalances
• Digoxin toxicity
• Excess levels of urea and other nitrogenous waste products in the blood (azotemia) and kidney failure

EXPECTED COURSE AND PROGNOSIS

• Prognosis varies with underlying cause

KEY POINTS

• Failure of the left side of the heart to pump blood at a sufficient rate to meet the needs of the body or to prevent blood from pooling within the veins of the lungs
• Some congenital (present at birth) heart defects, heart-muscle diseases (known as "cardiomyopathies"), and heart valve diseases have a genetic basis in some breeds
• Left-sided congestive heart failure is not curable, with few exceptions (such as animals with thyroid disorders, irregular heart beats [arrhythmias], nutritionally responsive heart disease)