

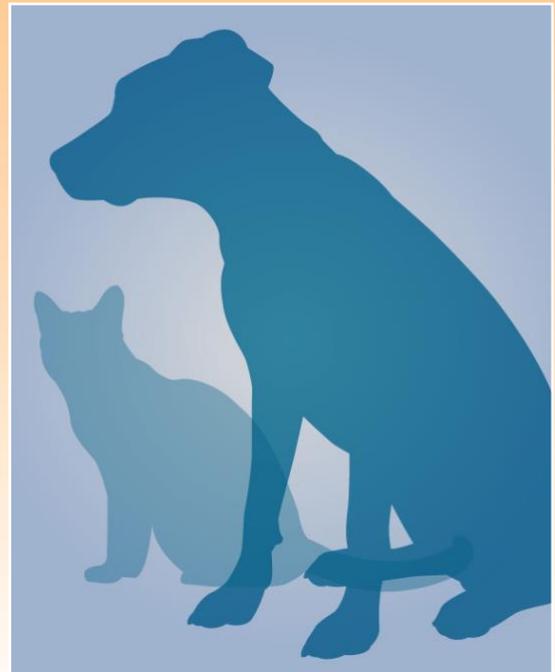
Hypertension, Systemic

(High Blood Pressure Throughout the Body)

Basics

OVERVIEW

- “Systemic” refers to the entire body versus individual parts of the body; “hypertension” is high blood pressure
- 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)
- “Systolic” refers to “systole,” which is the period when the heart (especially the ventricles) contract to push blood into the lungs (right ventricle) or body (left ventricle)
- “Diastolic” refers to “diastole,” which is the period when the heart (especially the ventricles) relaxes to allow blood to fill the chambers
- “Systemic hypertension or HT” is a sustained elevation in systolic or diastolic (or both) arterial blood pressure; in dogs and cats, systolic blood pressure of 160 mm Hg or higher or diastolic blood pressure of 120 mm Hg or higher is considered abnormal, no matter what method is used to measure blood pressure
- Elevations in blood pressure may be temporary and related to measurement artifact (stress-induced or “white-coat” effect [that is, being in the animal hospital and being nervous around the veterinary staff]) or sustained and related to disease
- High blood pressure usually is due to an underlying disease in dogs and cats, and is termed “secondary hypertension”
- If no underlying disease is present or can be identified, the terms “primary hypertension,” “essential hypertension” or “idiopathic hypertension” are used—“idiopathic” refers to “unknown cause;” if the hypertension is due to another disease process, it is termed “secondary hypertension”



GENETICS

- Colonies of dogs with high blood pressure have been produced by mating dogs with primary (essential or idiopathic) hypertension; mode of inheritance is not known

SIGNALMENT/DESCRIPTION OF PET

Species

- Dogs
- Cats

Mean Age and Range

- Usually seen in older dogs and cats, consistent with development of underlying disease (such as high levels of thyroid hormone [known as “hyperthyroidism”], long-term [chronic] kidney disease, or excessive levels of steroids produced by the adrenal glands [known as “hyperadrenocorticism” or “Cushing's syndrome”])
- Younger pets may be affected if they have kidney disease due to infection (such as leptospirosis) or an inherited kidney disease (such as polycystic kidney disease)

SIGNS/OBSERVED CHANGES IN THE PET

- Sudden (acute) blindness
- Bleeding within the eye
- Dilated pupils
- Separation of the back part of the eye (retina) from the underlying, vascular part of the eyeball (known as the “choroid;” condition known as “retinal detachment”); the “retina” contains the light-sensitive rods and cones and other cells that convert images into signals and send messages to the brain, to allow for vision
- Nervous system signs, such as depression, head tilt, seizures; disorientation; wobbly, incoordinated or “drunken” appearing gait or movement (known as “ataxia”); circling; weakness or partial paralysis; short, rapid movements of the eyeball (known as “nystagmus”)
- Increased urination (known as “polyuria”) and increased thirst (known as “polydipsia”) with progression of long-term (chronic) kidney disease
- Blood in the urine (known as “hematuria”); presence of protein in the urine (known as “proteinuria”)—protein in the urine is detected by diagnostic tests (such as dipstick, microalbuminuria testing, and urine protein-to-creatinine ratio) performed as part of the urine evaluation
- Bleeding in the nose and nasal passages (known as “epistaxis” or a “nosebleed”)
- Heart murmurs and sequence of three heart sounds (known as a “gallop rhythm”), when listening to the heart with a stethoscope; gallop rhythm is heart beats that sound like a galloping horse instead of normal “lub-dub”
- Pet may be in congestive heart failure (rare); signs include cough; difficulty breathing (known as “dyspnea”); bluish discoloration of the skin and moist tissues of the body caused by inadequate oxygen levels in the red blood cells (discoloration known as “cyanosis”); “congestive heart failure” is a condition in which the heart cannot pump an adequate volume of blood to meet the body's needs
- Enlarged thyroid gland may be present in cats, when increased levels of thyroid hormone (hyperthyroidism) is cause of high blood pressure (hypertension)

CAUSES

Primary or Essential Hypertension

- Not known in most pets
- Familial (runs in certain families or lines of animals) in some dogs

Secondary Hypertension

- Accounts for most cases in dogs and cats
- Kidney disease (chronic kidney disease—HT seen in 25% of dogs, in 19-65% of cats)
- Increased levels of steroids produced by the adrenal glands (hyperadrenocorticism or Cushing's syndrome)—HT seen in 73-80% of dogs)
- Increased levels of thyroid hormones (hyperthyroidism)—HT seen in 9-23% of cats
- Diabetes mellitus (“sugar diabetes”)—less common cause of high blood pressure (hypertension)—HT seen in 24-46% of dogs
- Pheochromocytoma—tumor of the adrenal gland; less common cause
- Increased levels of aldosterone, the hormone that regulates sodium and potassium in the body (condition known as “hyperaldosteronism”)—rare condition, usually due to a tumor in the adrenal gland; less common cause
- Central nervous system disease—less common cause

Treatment

HEALTH CARE

- If possible, treat as an outpatient
- Based on classification of the patient according to standards
- Hospitalization may be stressful to the pet
- Therapy will be recommended for any dog or cat with sustained systolic BP greater than 200 mm Hg, or diastolic BP greater than 120 mm Hg regardless of other signs or in general, for those with clear evidence of damage from the high pressures; with mild elevation and no signs, monitoring will be recommended
- Inpatient care may be necessary depending upon the underlying condition (such as the need for fluid therapy in a pet with kidney failure) or serious complications related to hypertension, such as nervous system signs or sudden bleeding into the retina (known as “acute retinal hemorrhage”)

ACTIVITY

- Depends on condition and underlying cause, restriction if acute blindness

DIET

- Influenced by underlying cause; salt (sodium) restriction is considered controversial and, if used alone, is unlikely to lower blood pressure
- Avoid high salt intake

SURGERY

- Dictated by underlying cause; may be indicated for some underlying causes

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.

- Treat underlying cause, if possible; HT may persist even if underlying condition is well controlled
- Dogs—medications to decrease blood pressure, such as angiotensin converting enzyme (ACE) inhibitor (for example, enalapril, benazepril) or calcium channel blocker (example, amlodipine); ACE inhibitors generally are selected as initial treatment due to the frequency of underlying protein in the urine (proteinuria), with amlodipine added on if necessary
- Cats—medications to decrease blood pressure, such as calcium channel blocker (example, amlodipine) or ACE inhibitor (example, benazepril); amlodipine generally is the first medication selected, with the addition of an ACE inhibitor, if protein is present in the urine (proteinuria)
- Spironolactone and hydralazine may be added to treatment if ACE inhibitors and amlodipine are ineffective in lowering the blood pressure to less than 150 mm Hg
- In emergency management, injectable hydralazine, sodium nitroprusside, or labetalol can be used; continuous direct blood-pressure monitoring is necessary

Dihydropyridine Calcium Channel Blockers

- Medications to enlarge or dilate blood vessels (amlodipine)—for ongoing, not acute management of HT

ACE Inhibitors

- Reduce resistance in the blood vessels by dilating them and also reduce output heart volume (enalapril, benazepril are examples), considered protective for kidney

Angiotensin Receptor Blockers (ARBs)

- Direct blood vessel dilating action, reduces secretion of vasopressin and reduces aldosterone production (example, Telmisartan, dogs)

Direct-acting Vasodilators

- Lower resistance in the blood vessels directly (hydralazine)

Alpha-receptor Antagonists

- Phenoxybenzamine is an example, usually used when pheochromocytoma present, with a beta-receptor antagonist

Beta-receptor antagonists (β -blockers)

- Propranolol or atenolol for example, lower heart rate and output, block effects of excess thyroid hormones, may be used for pheochromocytoma in dogs

Follow-Up Care

PATIENT MONITORING

- Blood pressure measurements of less than 150/100 mm Hg are the treatment goal blood pressure; however, a systolic blood pressure of less than 160 mm Hg is reasonable and will minimize risk of organ damage
- Blood pressure and complications of high blood pressure (especially changes in the back of the eye [retina; changes known as “retinopathy”]) should be checked weekly until blood pressure is controlled
- Laboratory tests to measure side effects of medications and clinical disease response, as needed

POSSIBLE COMPLICATIONS

- Congestive heart failure, a condition in which the heart cannot pump an adequate volume of blood to meet the body's needs (rare)
- Kidney disease
- Kidney failure
- Degeneration of the retina (back part of the eye) due to high blood pressure (known as “hypertensive retinopathy”); bleeding in the retina or separation of the back part of the eye (retina) from the underlying, vascular part of the eyeball (retinal detachment)
- Bleeding or blockage of blood flow in the brain (known as a “cerebral vascular accident”) leading to various central nervous system signs
- Amlodipine therapy may lead to gum overdevelopment (known as “gingival hyperplasia”) in dogs

EXPECTED COURSE AND PROGNOSIS

- Dictated by underlying cause of high blood pressure (hypertension)
- Blood pressure can be controlled with appropriate therapy in most pets, but therapy for high blood pressure does not necessarily improve survival time

Key Points

- “Systemic hypertension” is a sustained elevation in systolic or diastolic (or both) arterial blood pressure; in dogs and cats, systolic blood pressure of 160 mm Hg or higher or diastolic blood pressure of 120 mm Hg or higher is considered abnormal, no matter what method is used to measure blood pressure
- Unless underlying cause is curable or controllable, or it is mildly elevated without signs, the pet is likely to be on medications to control blood pressure (known as “antihypertensive medication”) for life
- Uncontrolled high blood pressure (hypertension) can lead to various medical conditions such as retina bleeding or detachment; progressive kidney damage; heart disease; or nervous system signs