



# Systemic Hypertension

(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” is a sustained elevation in systolic or diastolic (or both) arterial blood pressure; in dogs and cats, systolic blood pressure of 140 mm Hg or higher or diastolic blood pressure of 90 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
- Increased levels of steroids produced by the adrenal glands (hyperadrenocorticism or Cushing's syndrome)
- Increased levels of thyroid hormones (hyperthyroidism)
- Diabetes mellitus (“sugar diabetes”)—less common cause of high blood pressure (hypertension)
- Pheochromocytoma—tumor of the adrenal gland; less common cause of high blood pressure (hypertension)
- 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 of high blood pressure (hypertension)
- Central nervous system disease—less common cause of high blood pressure (hypertension)

# Treatment

## HEALTH CARE

- If possible, treat as an outpatient
- Hospitalization may be stressful to the pet
- 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 high blood pressure (hypertension), such as nervous system signs or sudden bleeding into the retina (known as “acute retinal hemorrhage”); the “retina” is the back part of the eye

## ACTIVITY

- Depends on condition and underlying cause

## 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
- Dogs—medications to decrease blood pressure, such as angiotensin converting enzyme (ACE) inhibitor (for example, enalapril, benazepril, or lisinopril) 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)
- 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 160 mm Hg
- In emergency management, injectable hydralazine, sodium nitroprusside, or labetalol can be used; continuous direct blood-pressure monitoring is necessary
- Medications to enlarge or dilate blood vessels, such as hydralazine or phenoxybenzamine
- $\beta$ -blockers (for example, propranolol or atenolol)

# Follow-Up Care

## PATIENT MONITORING

- Blood pressure measurements of less than 140/90 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

## POSSIBLE COMPLICATIONS

- Congestive heart failure, a condition in which the heart cannot pump an adequate volume of blood to meet the body's needs
- 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

### **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 140 mm Hg or higher or diastolic blood pressure of 90 mm Hg or higher is considered abnormal, no matter what method is used to measure blood pressure
- Unless underlying cause is curable or controllable, 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 bleeding in the back of the eye [retina]; separation of the back part of the eye from the underlying, vascular part of the eyeball [retinal detachment]; progressive kidney damage; heart disease; or nervous system signs)

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