RECOMMENDATIONS
conversations with a cardiologist

CARDIAC EDUCATION group

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Which Patients Should Be Screened for Systemic Hypertension?

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Hypertension in dogs and cats is a multisystem disorder, resulting in nonspecific clinical signs. The clinical consequences of hypertension can be devastating – including blindness, kidney disease, neurologic signs, and impaired cardiac and vascular function. As such, it is important to have a plan for which animals should be screened for this disorder. Specific recommendations on how to measure blood pressure (BP) in practice can be found here. A detailed description of the clinical syndrome of hypertension can be found here and further information can be obtained from a recent consensus statement by the American College of Veterinary Internal Medicine on the management of systemic hypertension.

There are three major indications for BP testing in dogs and cats: (1) presence of risk factors known to result in hypertension, (2) presence of underlying diseases that may be exacerbated by hypertension, and (3) presence of signs or findings consistent with target organ damage and hypertension. Importantly, these indications may overlap: testing for hypertension, screening for risk factors, and treatment should be pursued regardless of whether the risk factor or the clinical finding is noted first **(Figure 1)**.

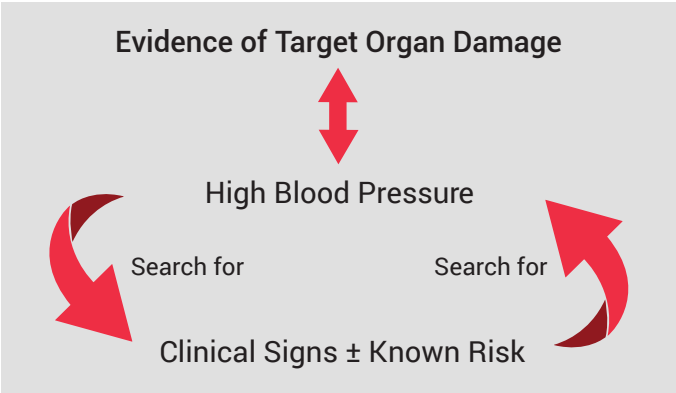
Risk Factors

Age — In studies of humans, dogs, and cats a relationship between BP and age is often reported, with a gradual increase in BP with advancing age. In animals, it is unknown if this increase in BP with age reflects arterial stiffening or increased prevalence of subclinical conditions leading to secondary hypertension (e.g., chronic kidney disease). Certainly, the prevalence of co-morbidities that lead to hypertension is higher in senior and geriatric animals. All dogs and cats over the age of 7 years should have their BP measured at least once a year as a screening test for hypertension. If systemic hypertension is confirmed in an animal without known risk factors or clinical signs, confirmation of the hypertensive state and testing to identify as-yet undiagnosed systemic conditions can begin.

Underlying Disease — Secondary hypertension is the most common cause of hypertension in dogs and cats. Conditions associated with development of hypertension in small animals include chronic kidney disease, acute kidney injury, proteinuria, hyperthyroidism, hyperadrenocorticism, hyperaldosteronism, pheochromocytoma, growth hormone excess, and diabetes mellitus. If any of the above conditions are diagnosed in a dog or cat, BP measurement should be part of the medical work-up for that patient.

Medications — Certain medications used in clinical practice can have vasoactive effects, leading to hypertension. Examples include phenylpropanolamine, toceranib, and erythropoiesis-stimulating agents (recombinant erythropoietin, darbopoietin, etc). Likewise, certain intoxicants such as cocaine, methamphetamine, pseudoephedrine, and 5-hydroxytryptophan can cause acute elevations in BP. Animals on a vasoactive medication or suffering from an intoxication of vasoactive drugs should have BP measured and monitored.

FIGURE 1



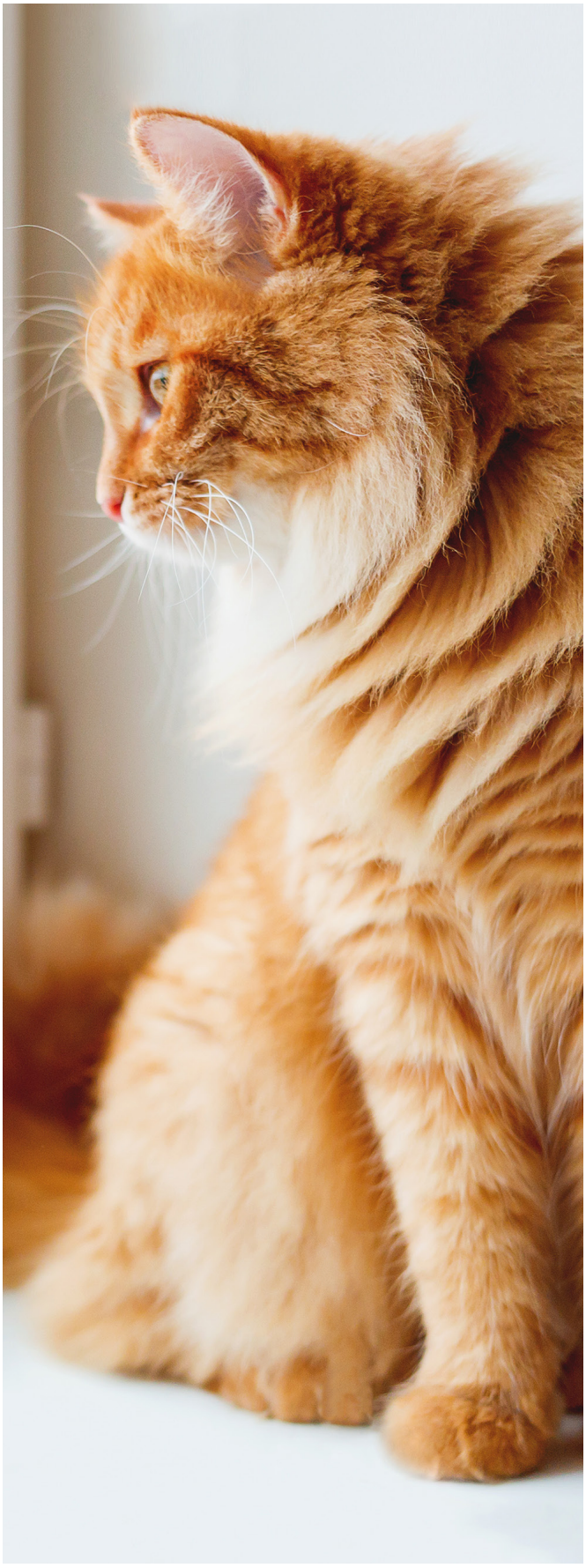
In practice, animals may first be presented with evidence of target organ damage, prompting BP measurement and a search for underlying risk factors. Likewise, animals may first be recognized as having known risk factors that prompt BP measurement and a search for evidence of target organ damage.

Underlying Diseases Exacerbated by Hypertension

Clinical findings of disease (heart murmur, polyuria/polydipsia) may be markers of conditions that are exacerbated by hypertension – diseases of the heart and kidney are particularly relevant and should be considered.

Heart Disease — Left-sided heart disease (myxomatous mitral valve degeneration, cardiomyopathies) can be exacerbated by hypertension. The increased afterload associated with hypertension leads to increased wall stress and compensatory remodeling (concentric hypertrophy). In a diseased left ventricle (e.g., a patient with cardiomyopathy), the ability to compensate is lessened or absent and cardiac failure is more likely to occur. In myxomatous mitral valve disease, the increase in left ventricular systolic pressure associated with hypertension leads to a greater pressure gradient between the left ventricle and left atrium driving more backward flow across the leaky valve. Dogs and cats with heart disease should undergo BP monitoring to confirm hypertension is not present.

Kidney Disease — Hypertension leads to glomerular hyperfiltration and progression of proteinuria, which in turn leads to progression of kidney disease. Kidney disease (whether acute injury or chronic disease) is both a risk factor that leads to hypertension, while also representing a disease state that is exacerbated by hypertension – as such, measurement of BP in the patient with kidney disease is critical to appropriate management.



Clinical Findings

The clinical signs of hypertension are non-specific and often vague. Subtle signs such as headache, flushing, or palpitations are challenging if not impossible to detect in animals. Clinical signs in the hypertensive animal most often reflect signs of underlying target organ dysfunction, with the eyes, brain, heart/vasculature, and kidneys being the major targets.

Ocular — New onset of blindness, visual impairment, or physical examination findings of ocular bleeding (hyphema, retinal hemorrhage or detachment) should prompt measurement of BP to rule out hypertension as a primary cause.

Neurologic — Neurologic dysfunction in hypertensive animals typically manifests as altered mentation (depression or obtundation), behavioral changes, or disorientation and less commonly as seizure activity, vestibular signs, or focal neurologic deficits. Unexplained neurologic signs in a dog or cat (particularly in the older animal) should prompt measurement of BP to screen for hypertension.

Cardiac — The heart is impacted by hypertension due to the increased afterload the condition imposes on the left ventricle. Chronic hypertension leads to left ventricular hypertrophy and reduced compliance, which may manifest on examination as a gallop sound or less frequently result in arrhythmias or a heart murmur. Animals with undiagnosed systemic hypertension may develop acute congestive heart failure unexpectedly when fluids are administered. Rarely, clinical signs attributable to aortic dissection (a tear in the wall layering of the vessel) such as acute pain, limb paresis, or sudden death may occur in the animal with hypertension. The presence of a gallop sound, findings of unexplained left ventricular hypertrophy, or the unexpected development of congestive heart failure after fluid administration should lead to BP measurement to establish a potential role of hypertension in the genesis of the findings. Importantly, the heart disease does not cause hypertension, but hypertension exacerbates heart and vascular disease as described above.

Renal — Kidney disease, whether acute or chronic, is both a risk factor and a clinical finding associated with hypertension. Any animal with kidney disease, whether chronic or acute kidney injury, should have BP measured and hypertension treated if documented. Likewise, animals that are presented with target organ damage (ocular, neurologic, or cardiovascular) should have a comprehensive kidney evaluation performed to detect the presence or absence of kidney disease as an underlying cause for the hypertension. Because hypertension leads to progressive kidney dysfunction, diligent monitoring for and treatment of hypertension in animals with kidney disease is important.

The algorithm in **Figure 2** summarizes both the risk factors and clinical findings that should prompt BP measurement in dogs and cats. Veterinarians should keep these scenarios in mind during the daily evaluation of dogs and cats; hypertension is a treatable condition and its manifestations may also be the first sign of underlying disease.

FIGURE 2

RISK FACTOR/FINDING	CLINICAL SCENARIO	RECOMMENDATION(S)
Risk Factors		
Age	HTN is associated with conditions that are more common in senior and geriatric animals. BP increases slightly with age.	Measure BP annually in all dogs and cats over 7 years of age.
Underlying Disease	• Chronic kidney disease • Acute kidney injury • Proteinuria • Hyperadrenocorticism • Hyperthyroidism • Diabetes mellitus • Pheochromocytoma • Hyperaldosteronism	Measure BP every 3-6 months in animals with these conditions to monitor for the development of hypertension.
Medications	These medications have been associated with HTN: • Phenylpropanolamine • Toceranib • Erythropoeitin/darbopoeitin • Intoxicants – cocaine, methamphetamine, etc.	Measure BP in every animal receiving these medications or exposed to these intoxicants.
Clinical Findings		Measure BP in any animal presenting with signs or physical examination findings that could represent target organ damage or having a condition that could be exacerbated by hypertension.
Ocular	• Blindness • Mydriasis • Bullous retinal detachment • Retinal edema or hemorrhage • Vitreal hemorrhage	
Neurologic	• Altered mentation • Behavioral changes • Ataxia, disorientation • Weakness, lethargy • Vestibular signs	
Cardiac	• Gallop sound • Arrhythmias • Syncope • Acute heart failure after fluid administration • Presence of structural heart disease (stage B/C/D)	
Renal	• Azotemia • Proteinuria • Acute kidney injury • Chronic kidney disease	

Indications for BP measurement include animals with risk factors known to result in hypertension, underlying diseases that may be exacerbated by hypertension, or clinical findings consistent with target organ damage.

Suggested Reading

1. Acierno MJ, Brown S, Coleman AE, Jepson RE, Papich M, Stepien RL, Syme HM. ACVIM consensus statement: Guidelines for the identification, evaluation, and management of systemic hypertension in dogs and cats. J Vet Intern Med 2018;32: 1803-1822.
2. Elliott J, Syme H, Jepson R, editors. Hypertension in the dog and cat, 1st edition. Cham, Switzerland: Springer International Publishing; 2020.
3. Taylor SS, Sparkes AH, Briscoe K, Carter J, Sala SC, Jepson RE, Reynolds BS, Scansen BA. ISFM consensus guidelines on the diagnosis and management of hypertension in cats. J Feline Med Surg 2017;19:288-303.

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