



Clinical Signs

Sustained high blood pressures target the arterial and arteriolar systems of the eyes, brain, heart, and kidney (target organs). The changes are referred to as target organ damage (TOD). The observation of TOD can help raise the suspicion of, and increase the opportunity to, diagnose hypertension in the cat.

TOD: Eyes

- Chronic, sustained increases in systolic blood pressure (SBP) can overwhelm any autoregulatory mechanisms or blood-retinal barriers, resulting in hypertensive retinopathy, choroidopathy, and optic neuropathy
 - Hypertensive retinopathy: tortuosity of retinal vessels, retinal hemorrhages, intraretinal edema
 - Hypertensive choroidopathy: severe bullous retinal detachment, choroidal hemorrhages
 - Hypertensive optic neuropathy: papilledema and secondary optic nerve atrophy



- **Presenting complaints:** blindness, mydriasis, vitreous hemorrhage, hyphema, none
- **Potential clinical findings:** blindness, mydriasis, retinal hemorrhage, multifocal retinal edema, retinal vessel tortuosity, retinal perivascular edema, papilledema, vitreous hemorrhage, hyphema, secondary glaucoma, retinal degeneration
- **Changes can occur as early as 168 mmHg SBP and risks increase substantially >180 mmHg SBP**
- The benefit of routine fundic examinations:
 - Become familiar with normal
 - Become comfortable with examination techniques
 - Detect changes early before retinal detachment
 - Detect hypertension early as ocular changes may prompt blood pressure testing

Clinical Signs continued

TOD: Eyes continued



Direct Retinal Exam



Indirect Retinal Exam

- **The one-minute retinal exam**

- Pupillary dilation is essential for a good retinal examination. Ensure the cat does not have glaucoma, then dilate the pupils with 1-2 drops of tropicamide. Dilation takes 5-10 minutes
- Darken the room
- **Direct**
 - Equipment: ophthalmoscope
 - Provides small field of view at higher magnification
 - Images are upright
- **Indirect: monocular and binocular**
 - Equipment: handheld lens and bright focal light source or indirect headset
 - Preferred method for small cats
 - Larger field of view
 - Images are inverted and reversed

TOD: Brain

- Neurologic signs may occur in as many as 29%-46% of hypertensive cats
- Anatomic changes in hypertensive encephalopathy include:
 - White matter edema and vascular lesions described in humans with hypertension
 - Vasogenic edema in the occipital and parietal lobes of the brain
 - Hemorrhage and infarction in the CNS
- A response to anti-hypertensive medications can be observed early in the disease process
- Hypertensive encephalopathy is more likely to occur in cats with a sudden increase in blood pressure (BP), an SBP above 180 mmHg, or both
- **Presenting complaints: nighttime howling, acting lost, disorientation, balance disturbances, vision loss, hearing loss, altered mentation, seizures, other changes in behavior**



Clinical Signs continued

TOD: Brain continued

- **Potential clinical findings:** signs consistent with intracranial disease including lethargy, ataxia (subtle), vestibular signs, head tilt, nystagmus, evidence of seizure activity, evidence of stroke, and/or paralysis
 - Behavioral changes may not be observed during exam
 - **Signs of hypertension may be misattributed to cognitive dysfunction syndrome**
 - Other hypertension-related risks in the CNS include **ischemic myelopathy** of the cranial cervical spinal cord, potentially leading to ambulatory tetraparesis or tetraplegia. These cats may present with SBP readings below normal

TOD: Heart and Vasculature

- Sustained hypertension is associated with increased systemic vascular resistance, which can lead to increased left ventricular wall stress resulting in concentric left ventricular hypertrophy
- Left-sided congestive heart failure is an uncommon complication
- Aortic aneurysm/dissection is a rare complication and requires a high index of suspicion prompting advanced imaging for diagnosis
- **Presenting complaints: signs consistent with heart disease (lethargy, weakness, collapse, lameness, inability to use limbs, pain), none**
- **Potential clinical findings:** systolic murmur, gallop murmur, arrhythmias as an indication of hypertrophic disease, saddle thrombus (absence of pulse, cold extremity, look for cyanosis at nail beds, pain), increased heart rate, increased respiratory rate, jugular vein distension (congestive heart failure), epistaxis
- Changes can occur with sustained hypertension, with risks increasing when >180 mmHg SBP
- **Diagnostic tests:** auscultation, palpation of peripheral pulses, assessing for jugular vein distension, thoracic radiographs, electrocardiogram, echocardiogram
- Degree of hypertrophy does not correlate with magnitude of hypertension
- Check and compare pulses in all limbs

TOD: Kidneys

- Sustained hypertension is associated with progression of kidney disease, but a direct cause remains uncertain. Many cats with hypertension have concurrent CKD and which came first is often difficult to determine
- A controlled study of over 200 cats demonstrated increased glomerulosclerosis and arteriosclerosis in cats with elevated BP
- Hypertension has been associated with proteinuria and histological kidney injury in both experimental models and naturally occurring disease
- Proteinuria has been associated with more rapid progression of kidney disease
- **Presenting complaints: signs consistent with kidney disease (PU, PD, weight loss, decreased appetite, vomiting, lethargy), ocular lesions, uremic breath, decreased body condition score (BCS) or muscle condition score (MCS), none**
- **Potential clinical findings:** weight loss, fundic changes, uremic breath, oral ulcerations, small irregular kidneys or big kidney/little kidney upon abdominal palpation, none
- Clinical pathology findings: serial increases in serum creatinine, SDMA, persistent proteinuria or microalbuminuria, decreased glomerular filtration rate (GFR)
- Changes can occur with sustained hypertension with a moderate risk increasing when >160 mmHg SBP
- **Diagnostic tests:** serum creatinine, blood urea nitrogen (BUN), SDMA, urinalysis and quantitative assessment of proteinuria or albuminuria, GFR measurement, survey abdominal radiographs, abdominal ultrasonography
- Hypertensive cats may be nonazotemic but proteinuric
- Establishing baseline kidney biomarker values is important for monitoring progression of disease and response to therapy. Watch for trends in values!
- Recognize onset of kidney dysfunction early