

DIAGNOSIS AND TREATMENT OF HYPERTENSION IN CATS AND DOGS

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Categories : [Vets](#)

Date : May 28, 2012

Rachel Sant assesses some of the issues around high blood pressure, including the potential problems in taking accurate readings and treatment options

Summary

Hypertension is defined as a persistently elevated blood pressure. It often presents as sudden onset blindness caused by retinal detachment, although more subtle signs can be seen earlier in the disease process, and organs other than the eye can also be affected. Underlying diseases such as chronic renal disease or hyperadrenocorticism are much more common than primary (idiopathic) hypertension so medical investigation should always be pursued. Treatment and regular monitoring are recommended to prevent or slow progression of disease.

Key words

hypertension, end-organ damage, amlodipine, ACE inhibitors

BLOOD pressure is the product of cardiac output (heart rate multiplied by stroke volume) and peripheral resistance, so is affected by anything altering any of these three variables. Hypertension is the persistent elevation of blood pressure (BP) above that expected in the species.

It can be difficult to assess accurately, as readings may be affected by, for example, stress or

positioning, so it should only be diagnosed if readings are reliable and persistently elevated in calm patients.

Some dog breeds, for example, sight hounds, have reference ranges above those of other breeds of dogs. The level at which BP is considered abnormally high is not clear cut, but a level of around 170mmHg systolic BP in dogs and cats is often used as a cut off. Chronic elevation of BP may be associated with damage to end-organs (or “target organs”), such as the eye, brain, heart or kidneys.

Animals may be presented for signs consistent with hypertension (particularly cats) or hypertension may be discovered as part of an examination – for example, BP taken as part of geriatric monitoring. Treatment should be initiated if there are clinical signs or if BP is persistently elevated on several occasions. Hypertension is often not diagnosed until major end-organ damage has occurred.

BP should be measured before any stressful procedures or after a period of acclimatisation if possible. Animals may be more relaxed and easier to manage if their owners hold them or remain present in the room. Multiple readings should be taken for accuracy and a standard procedure should be used so the readings are repeatable (see panel). An experienced operator should be used to take measurements because technical problems are then less likely.

Blood pressure can be measured directly (a probe within an artery) or indirectly, the more common method in veterinary practice. Doppler or oscillometric techniques can be used and seem to correlate quite well with direct measurements, although the Doppler technique is probably the most reliable in conscious cats.

The Doppler technique uses ultrasound waves to detect blood flow in an artery and make it audible. Earphones can be used in nervous patients that may be disturbed by the noise. Systolic blood pressure is most easily measured by the Doppler technique, since diastolic pressures are less reliable.

In humans, hypertension is associated with cardiovascular, central nervous system (CNS), renal or ocular problems.

In animals, the most common presenting complaint is sudden-onset blindness due to hypertensive retinopathy (intraocular haemorrhage, retinal oedema and/or retinal detachment), but signs of hypertensive encephalopathy, renal disease or epistaxis can also be seen. Left ventricular hypertrophy can occur secondarily to hypertension, but clinically apparent heart disease rarely occurs unless there is a pre-existing cardiac problem.

Hypertension may be artifactual (stress-related due to a veterinary visit; the “white coat effect”), occur secondary to drug administration or underlying disease processes (such as chronic kidney

disease, hyperadrenocorticism, hyperaldosteronism or phaeochromocytoma), or occur in the absence of potentially causative disease, that is primary or idiopathic hypertension.

Primary hypertension is much less common than secondary hypertension, so animals should always be investigated for other diseases that may be at least partially amenable to treatment.

Drugs such as glucocorticoids, erythropoietin or drugs causing vasoconstriction (for example, phenylpropanolamine), may cause hypertension, and transient hypertension can even be seen in animals given topical treatments such as phenylephrine. A full history including any drug administration is, therefore, essential.

Hypertension in cats is most commonly associated with chronic renal failure. Hyperthyroidism has historically been reported to be associated with a high incidence of hypertension in cats, although this number is probably smaller than previously thought and the numbers may be complicated by cats with concurrent renal disease.

Dogs seem to present with hypertension less commonly than cats, but it may be seen with renal disease (especially glomerular disease), hyperadrenocorticism, diabetes mellitus or phaeochromocytoma.

Middle-aged to older animals are most often diagnosed with hypertension, most probably due to the increased prevalence of diseases related to high BP in this age group.

Animals being treated with drugs that may increase BP or that have diseases possibly associated with hypertension should be carefully evaluated even if there is no obvious end-organ damage as subtle abnormalities, such as lethargy, may be seen in hypertensive patients. Full physical examination, including neurological examination, auscultation of the heart and ocular exam, should be performed in these patients.

Further investigation of hypertension may include biochemical evaluation, complete blood count and urinalysis as a minimum. T4 measurement should be performed in cats. Abdominal ultrasound, adrenocorticotrophic hormone (ACTH) stimulation testing, urine protein:creatinine ratio or other tests may be required once a narrow differential diagnosis list has been formulated.

The goals of treatment are to reduce BP into the normal range and to slow or prevent progression of end-organ damage. If end-organ damage is already present, then hypertension should be treated once BP is greater than 160mmHg. If no signs are present, then it is sensible to first confirm the diagnosis with repeated measurements and to treat when the patient's BP is more than 180mmHg.

Current thinking is that minimal risk exists of end-organ damage at a systolic BP below 150mmHg, mild risk at 150 mmHg to 159mmHg, moderate risk at 160 mmHg to 179mmHg and severe risk at

greater than 180mmHg.

If hypertension is long-standing there may be compensatory mechanisms in cerebral vasculature, so acute reductions in BP may lead to compromised cerebral perfusion – that is, you are aiming to reduce BP in general but a sudden drop may be detrimental unless the risk of high BP is outweighed by the risk of acutely dropping it.

Drugs that increase BP should be avoided in any patient with hypertension. Drugs such as calcium channel blockers and ACE inhibitors are the most commonly used medications to treat hypertension once a reliable diagnosis has been made – that is, repeatable elevated measurements and/or end-organ damage.

Effective treatment of hypertension is that which reduces the BP to below 150mmHg systolic, a level where there is minimal risk of end organ damage. This will partially or fully resolve some hypertensive changes, such as left ventricular hypertrophy or hypertensive encephalopathy, and may slow or prevent progression of other hypertensive diseases such as chronic kidney changes. Retinal reattachment is possible with effective treatment of hypertension but restoration of vision is unlikely in cases of blindness due to retinal detachment.

Amlodipine is a calcium channel blocker that reduces peripheral resistance by causing vasodilation and, therefore, drops BP. It preferentially dilates the afferent arteriole in the kidney, so, potentially, can increase intraglomerular pressure, although the effective drop in BP overall generally counteracts this.

It is commonly used for treatment of hypertension and is very effective in cats, although perhaps less so in dogs (so the afferent arteriolar dilation may be more of an issue in this species). It is metabolised in the liver, so the dose should be reduced in cases of hepatic dysfunction. Side effects are rare and include lethargy, hypotension or inappetence. As it is dosed once daily, this improves compliance compared to some other medications. Regular monitoring of BP is required.

Angiotensin converting enzyme (ACE) inhibitors, such as benazepril and enalapril, cause venodilation and arterio-dilation, and reduce salt and water retention due to reduced aldosterone production. Efferent arteriolar dilation in the kidney can cause reduced intraglomerular pressure, which may reduce proteinuria.

ACE inhibitors can be used in addition to amlodipine, especially if there is poor response to this medication, or can be used specifically for treating underlying disease – for example, proteinuria/renal disease. They generally have a smaller effect on BP reduction than amlodipine, but can be useful for their renoprotective action and may be used alone in patients with glomerular disease, as reduction in proteinuria is associated with longer survival times. Monitoring creatinine, urea and electrolyte levels should be carried out regularly when using this class of drugs. Treatment should be stopped if hypotension, azotaemia or hyperkalaemia develops. Other side

effects, such as anorexia, vomiting or diarrhoea, are rare.

Sometimes diuretics such as furosemide are used in acute situations, but should not be used in patients with dehydration or metabolic imbalances and are not suitable for long-term use. Beta adrenergic blockers, such as atenolol or propranolol, reduce heart rate and contractility, and so reduce cardiac output. They are generally not effective as a single agent, but may be helpful in cats with hyperthyroidism, as these patients have an exaggerated response to catecholamines.

Alpha blockers can be used to cause reduce BP via vasodilation, but are generally ineffective as single agents, although phenoxybenzamine has been used for treating hypertension caused by phaeochromocytoma.

Regular follow-ups are important in all hypertensive patients, and the number and frequency will vary according to the severity of clinical signs and the treatment chosen. Regular physical examination, funduscopy, BP measurement, urinalysis and serum creatinine concentration should be performed regularly.

• **Some of the treatments mentioned in this overview may not be licensed for veterinary or species-specific use.**

References

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STANDARD PROCEDURE FOR TAKING BLOOD PRESSURE (BP) MEASUREMENTS BY THE DOPPLER TECHNIQUE

A QUIET room should be selected away from other patients and noise and the patient allowed to relax for a short while.

The animal should be held in a relaxed, comfortable position (dogs generally in lateral recumbency, cats however they will allow; see [Figures 1](#) and [2](#)) and the BP measured from a limb (or the tail). In dogs the relevant limb should be held so that the probe is positioned at about the level of the heart (see [Figure 3](#)); this is less important in cats due to their small size.

The Doppler probe is placed on the forelimb below the carpal pad, or just distal to the tarsal pad if using the hindlimb, after shaving the area and applying a small amount of gel to the probe for good contact. The cuff is inflated until the audible blood flow stops and then is gradually deflated.

The cuff used should be as wide as about 40 per cent of the circumference of the limb (a too small cuff will tend to artificially increase BP and a too large cuff will reduce it). The cuff size and site of cuff placement should be recorded so that the same cuff and positioning is used the next time the patient's BP is measured in the future.

Multiple readings should be taken, the first discarded and then an average taken of another five or six readings taken over a few minutes. If there are any widely varying values or if the patient is moving, the value should be discarded and further measurements taken.