

Doppler blood pressure measurement in conscious cats

A guide for veterinary professionals



Why measure blood pressure (BP)?

- Persistently high BP risks target organ damage (TOD). The target organs are the:
 - Brain (eg behavioural changes, dementia, seizures)
 - Heart (eg murmur, gallop rhythm)
 - Kidneys (eg reduced urine specific gravity, proteinuria, increasing creatinine)
 - Eyes (eg visual deficits, blindness)
- Hypotension can occur for a variety of reasons and risks renal (and other) complications

When should I consider hypertension a possibility?

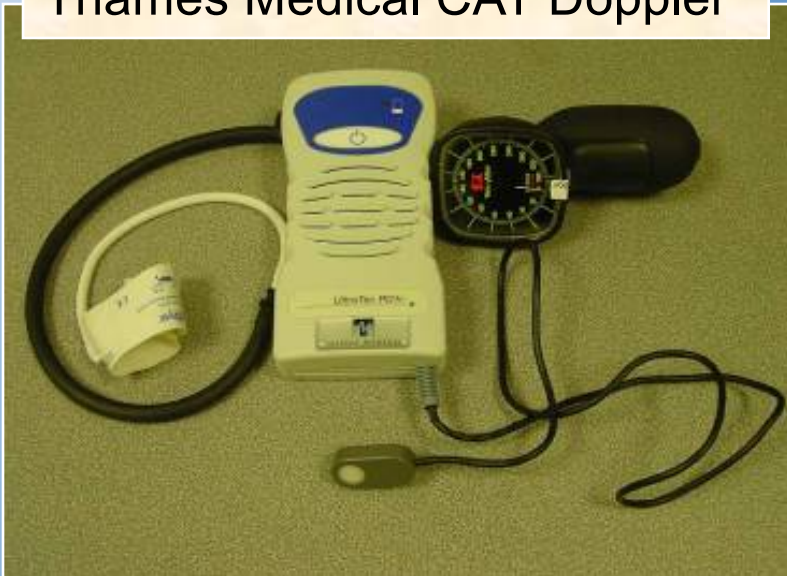
- Cats with
 - Visual deficits
 - Ocular disease consistent with high BP (see Free Download on ocular manifestations of systemic hypertension)
 - Any diseases with a known association eg chronic kidney disease, hyperthyroidism, primary hyperaldosteronism
 - Unexplained proteinuria
 - Heart murmur or gallop heard on auscultation
 - Left ventricular hypertrophy identified on echo
 - Behavioural/neuro signs (hypertensive encephalopathy)
 - Middle aged and older cats (> 7 y) – BP assessment is recommended as part of routine health screening

When should I consider hypotension a possibility?

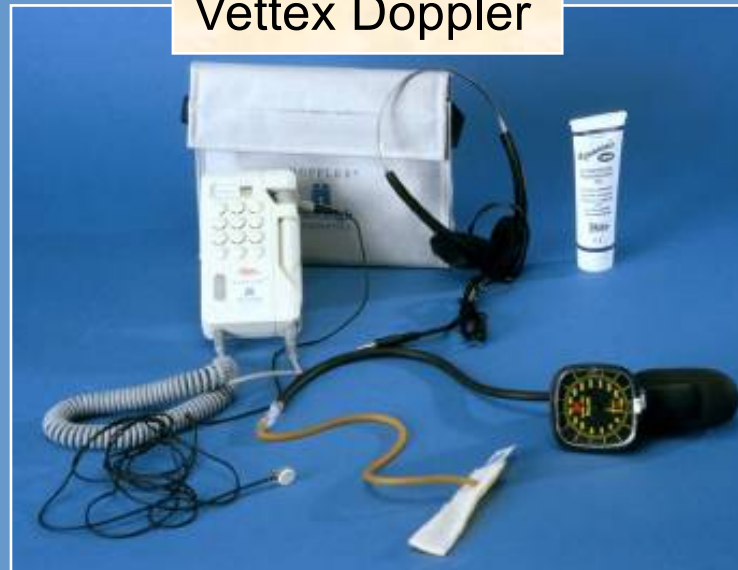
- Cats with
 - Hypovolaemia eg due to blood loss or dehydration
 - Sepsis
 - Acute pancreatitis
 - Myocardial failure
 - Anaesthetised cats
 - Following administration of certain drugs

Step 1: choose a Doppler blood pressure machine

Thames Medical CAT Doppler



Vettex Doppler



Parks Doppler

Step 2: Choose a suitable venue
(quiet and away from barking dogs, telephones etc!)



Step 3: 'acclimatisation' – let your cat relax for 10 minutes before proceeding

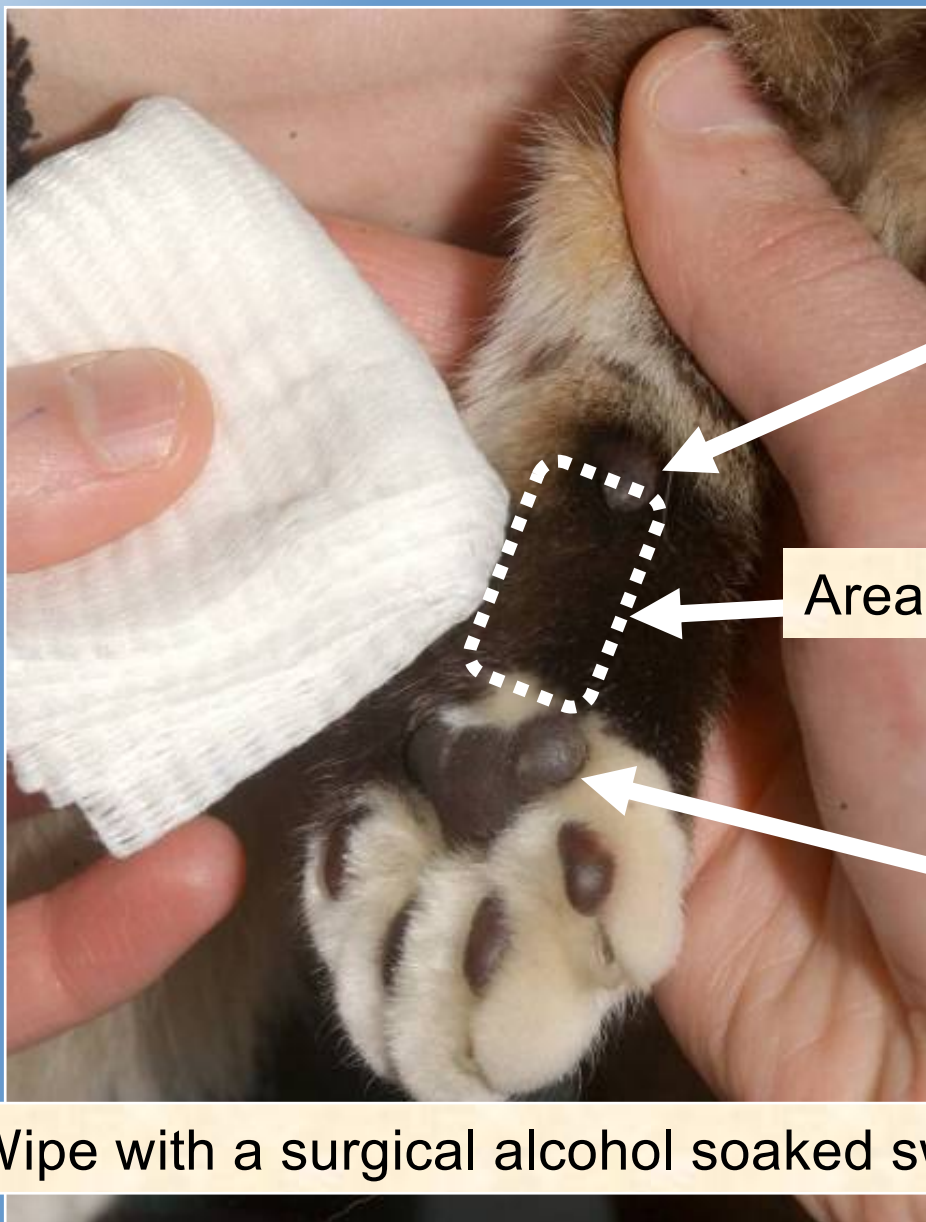


Step 4: place a 2.5 cm wide cuff between the elbow and carpus

The ideal cuff width is 30-40% of the limb circumference



Step 5: prepare the area over the artery



Carpal pad

Area to be prepared

Main foot pad

Wipe with a surgical alcohol soaked swab

*No need to clip the fur –
even for long-haired cats*

Step 6: apply ultrasound gel to the prepared area

Ultrasound gel



Step 7: put gel on the Doppler probe



Step 8: put on headphones, turn the machine on and, applying only very gentle pressure, find the pulse



Step 9: slowly inflate the cuff to ~ 20 mmHg above the point at which the pulse cannot be heard



Step 10: deflate the cuff slowly, record the SBP at the point when the pulse first becomes audible again, + DBP (**where possible**) where the sound changes tone

SBP 154 mmHg

DBP 86 mmHg



Step 11: completely deflate the cuff and repeat. Collect at least 5 readings, over 3-5 minutes, discarding the first if this is very different to the others



The tail and back legs can also be used to measure SBP



Picture included with kind permission of Professor Daniëlle Gunn-Moore, University of Edinburgh

Top Tips for success

- Don't rush!
- Have the owner present if possible - measure BP in outpatient clinics rather than admitting the cat to the hospital
- Take readings in a quiet and calm environment
- Always include a 5-10 minute acclimatisation period
- Minimal restraint – owner gently holding the cat
- Use headphones so the cat (and owner) cannot hear the noise of the procedure
- You can never have too much gel!
- Use ultrasound gel and not lubricant gel

Top Tips for success

- Don't press too hard
- Inflate the cuff gently in a step-wise fashion
- Get a good sphygmomanometer (one that deflates slowly and smoothly)
- Take at least 5 readings, deflating the cuff completely between each one and discarding the first reading/s if very different to the others
- Practice on anaesthetised cats
- Record the location used (eg forelimb or tail) and cuff size

Top Tips for success

- Be consistent in the location and size of cuff used when repeating measurements
- Use the correct sized cuff
 - Too wide a cuff will give a falsely lower SBP reading
- The cuff should be at the level of the right atrium (RA). If using a forelimb, use a 'hand-shaking' posture to achieve this
 - Cuffs below the RA will give falsely increased SBP readings
- Replace the cuff if uneven inflation ('ballooning') is seen
- Don't measure BP within 30 minutes of stressful procedures such as blood sampling

Interpretation of Doppler SBP results

- There is still much debate regarding SBP reference ranges!
 - Situational hypertension (previously called 'white coat' or 'stress associated' hypertension can increase SBP by up to 75 mmHg
- Develop your own clinic reference range
 - Never treat solely on the basis of a single high SBP result
- Consider
 - How noisy (or stressful) is your clinic?
 - How stressed is your patient?
 - Remember that stress is not always evident externally – if in doubt:
 - Repeat the SBP measurements
 - Always examine the eyes to check for evidence of hypertensive damage

Guidelines for interpretation of Doppler SBP results

- What is the mean SBP?
 - ≤ 119 mmHg
 - 120-139 mmHg
 - 140-159 mmHg
 - 160-179 mmHg
 - ≥ 180 mmHg
- What is the assessment?
 - The following guidelines incorporate the IRIS and ACVIM recommendations for cats with chronic kidney disease
www.iris-kidney.com

SBP \leq 119 mmHg

- Interpretation

- Low systolic blood pressure result
- Guidelines for low blood pressure are not well-defined
- SBP should be maintained above 90 mmHg in conscious cats and above 80 mmHg in anaesthetised cats
- Tactics for increasing SBP include, where appropriate:
 - Treating the underlying cause – eg: reducing the depth of anaesthesia; crystalloid +/- colloid fluid therapy

SBP 120-139 mmHg

- Normotensive: minimal risk of target organ damage (TOD)

SBP 140-159 mmHg

- Pre-hypertension: Mild risk of TOD
 - Many normal cats give readings in this range due to situational hypertension (stress-induced high BP readings)
 - Make sure that a 5-10 minute acclimatisation period is included before BP measurements are taken
 - Treatment only recommended if evidence of TOD
 - If the patient is known to have an illness predisposing to systemic hypertension (eg chronic kidney disease), 1-3 monthly monitoring of BP recommended; otherwise 3-6 monthly monitoring recommended

SBP 160-179 mmHg

- Hypertension: Moderate risk of TOD
 - If TOD already present, a diagnosis of systemic hypertension is confirmed and treatment should be started
 - If no evidence of TOD:
 - Could be situational hypertension
 - Recommend repeating BP measurements on 2 occasions over the next 2 months. If readings remain > 160 mmHg, look for known causes of high blood pressure (eg chronic kidney disease). If present, treatment is indicated. If not, decide whether to monitor or treat
 - Make sure that a 5-10 minute acclimatisation period is included before BP measurements are taken

SBP \geq 180 mmHg

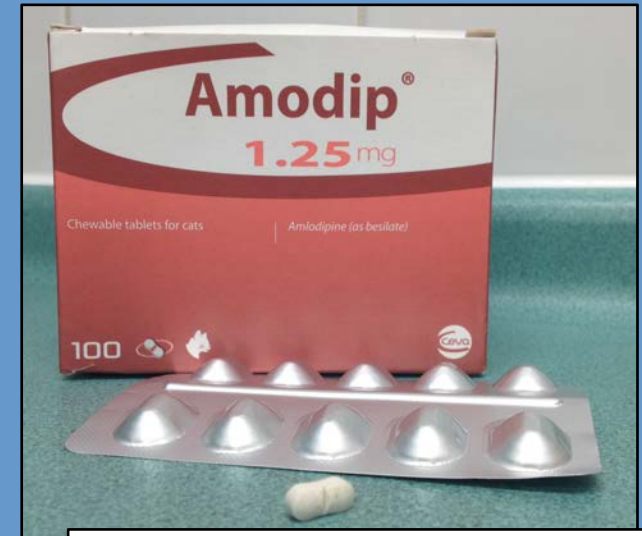
- Severe hypertension: Severe risk of TOD
 - If TOD already present, a diagnosis of systemic hypertension is confirmed and treatment should be started
 - If no evidence of TOD:
 - Could be situational hypertension
 - Recommend repeating BP measurements on 1-2 occasions over the next 1-2 weeks. If readings remain > 180 mmHg, treatment is indicated - especially if the cat is known to have a condition associated with high BP (eg chronic kidney disease)
 - Consider looking for known causes of high blood pressure (eg chronic kidney disease, hyperthyroidism)
 - Make sure that a 5-10 minute acclimatisation period is included before BP measurements are taken
 - Many hypertensive cats have SBP readings > 200 mmHg

Apparently 'normal' cats with 'high' SBP readings

- Always look for evidence of target organ damage (TOD)
eg ocular changes consistent with hypertension
 - If present, the diagnosis of hypertension is confirmed
- Never treat solely on the basis of a single high SBP reading
- If an unexpected result is received – repeat the assessment on a separate occasion
- Make sure that a 5-10 minute acclimatisation period is included before BP measurements are taken
- Consider looking for evidence of diseases associated with hypertension eg chronic kidney disease, hyperthyroidism
- Decide whether or not this is an unexpected finding
- Decide whether to monitor the SBP or treat

Treatment of systemic hypertension in cats

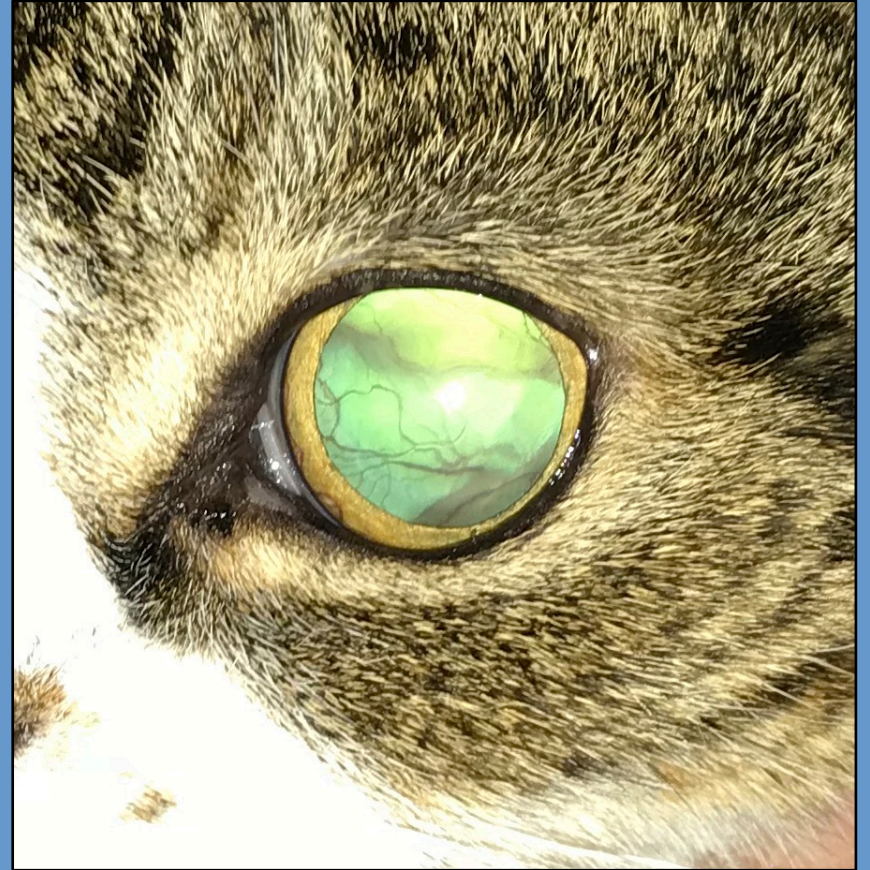
- *Amlodipine 0.625 – 1.25 mg/cat q24h
 - Typically reduces SBP by 30-70 mmHg
- *Telmisartan 2-3 mg/kg q24h
 - Typically reduces SBP by 20 mmHg
 - Can be used in combination with amlodipine at a dose of 1 mg/kg q24h
- Benazepril 0.5-1 mg/kg q24h
 - Can be used in combination with amlodipine at the above doses



* These products have a veterinary license for this indication

Treatment protocol

- Start treatment
- Reassess 7 days later
 - Measure SBP
 - Ocular examination
- If still hypertensive
 - Increase dose
 - +/- add in a second agent
 - Repeat SBP measurement in 7–10d
- Once stable, BP re-checks should be done every 2-4 months, according to the patient's needs



Conclusions

- Hypertension is a common and serious problem in cats
- It is easy to diagnose
 - The Doppler technique is most reliable in conscious cats
 - Ophthalmic examination is also very helpful
- It is easy (and very rewarding) to treat
 - Amlodipine is effective in almost all cases



Useful additional information

- Other Free Downloads on vetprofessionals.com
 - Examination of the feline eye and adnexa
 - Eye examination: equipment and techniques
 - Ocular manifestations of systemic hypertension
- Video tutorials
 - How to measure blood pressure
 - How to perform an eye examination
- Try googling and downloading these useful resources:
 - Taylor et al: ISFM consensus guidelines on the diagnosis and management of hypertension in cats (JFMS 2017)
 - Acierno et al: ACVIM Consensus statement on systemic hypertension (JVIM 2018)

Disclaimer

Vet Professionals has developed this document with reasonable skill and care to provide general information on Doppler blood pressure measurement and systemic hypertension in cats. This document however does not, and cannot, provide advice on any individual situation. It is not a substitute for advice from a veterinary surgeon on each individual situation. Vet Professionals therefore strongly recommends that users seek, and follow, advice from their veterinary surgeon on any health or other care concerns that they may have concerning their cats. Users should not take, or omit to take, action concerning the health or care of their cats in reliance on the information contained in this document and so far as permissible by law, Vet Professionals excludes all liability and responsibility for the consequences of any such action or omission in reliance on that information.

