

Critical Connections in Feline Patients

Hypertension, Chronic Kidney
Disease, and the Renin-Angiotensin-
Aldosterone System



Boehringer
Ingelheim

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A Note from Boehringer Ingelheim Animal Health USA

Boehringer Ingelheim is pleased to introduce this new booklet for you and your clients. This is an exciting time in veterinary medicine, especially pertaining to therapeutic solutions in feline medicine.

This booklet focuses on feline hypertension, its connection to chronic kidney disease, and the pivotal role we suspect that the renin-angiotensin-aldosterone system plays in both conditions. Both conditions are common in senior and geriatric cats, but hypertension often goes under- or undiagnosed until it has caused irreversible damage, especially to the target organs such as the kidneys, eyes, brain, and heart. The booklet also explores research that shows that cats diagnosed with one of these conditions often also experience the other. While we do not fully understand the connection between hypertension and CKD (and within the context of RAAS), we do have enough evidence to support frequent screening protocols for both diseases.

Cats are valued pets in homes across the country, so it's imperative that our community continues to make advancements in feline medicine. Boehringer Ingelheim Animal Health USA is fully committed to this goal, offering continuing education, investing in research



and development, and providing clinic support to help cats get the care that they need and deserve. This booklet, developed through a collaboration between Boehringer Ingelheim and AAHA, is designed to educate veterinary teams on the pathophysiology linking hypertension, CKD, and RAAS; to empower them to discuss feline hypertension and CKD with their clients; and to be confident in screening methods to diagnose and treat both conditions at earlier stages. Working together, we can help more clients spend quality years with their cats. We thank AAHA for their collaboration in the development and publication of this booklet in pursuit of this goal.



Feline Hypertension

Disease State and Associated Risks

Hypertension, or high blood pressure, is a common clinical problem in aged cats. The median age at diagnosis is 13–15 years, although cases in cats as young as 5–7 years have been reported.¹

Normotensive feline blood pressure is less than 140 mmHG (systolic blood pressure [BP], measured in millimeters of mercury).² Measurements consistently higher than 140 mmHg, therefore, define feline hypertension.

While some cats live their whole lives under 140 mmHG, others remain at risk for hypertension—often with blood pressure increasing slowly over time.³

The diagnosis frequently occurs once persistent and/or severe hypertension causes noticeable organ damage—sudden blindness, heart failure, etc. The other frequent presentation is association with other diseases. Veterinary teams need to be prepared for both clinical realities. Regularly screening feline patients for

hypertension may prevent such crises and the ensuing stress for the patients, their families, and the veterinary practice team.

Three Classifications of Hypertension

Cases of feline hypertension fall into three classifications: situational, idiopathic, and secondary.

Situational hypertension (previously called white-coat hypertension) occurs when some cats experience a transient increase in blood pressure due to the fight-or-flight response or stress in the veterinary setting. One cat's blood pressure increased 80 mmHg during a simulated clinical visit in one study.¹ Blood pressure measuring protocols, outlined in both the ACVIM and the ISFM consensus guidelines, take this into account and include strategies for mitigating the situational effect.

Idiopathic hypertension classifies cases where no specific disease is yet identified. This represents about 20% of cases.⁴



Idiopathic hypertension may ultimately serve as a warning sign that other diseases may emerge later.

Secondary hypertension represents the most cases of high blood pressure in cats. Risk factors associated with hypertension in cats include age (>7 years) and the presence of other diseases, most notably chronic kidney disease (CKD), but also including hyperthyroidism and rare cases of primary hyperaldosteronism, hyperadrenocorticism, or pheochromocytoma.⁵ Of these, CKD is the most common condition associated with hypertension. Available data show up to 74% of hypertensive cats are azotemic due to CKD, and up to 65% of cats with CKD are hypertensive.^{6, 7, 8, 9, 10}

While there remain areas of uncertainty and gaps in knowledge about feline hypertension, the following are recognized:

- There are links between hypertension and CKD, as well as between hypertension and aging
- The pathophysiologies of hypertension and CKD are intertwined
- Since hypertension is often silent in nature, mature cats, as well as those with CKD, should be screened, so that necessary treatment can be implemented before target organ damage develops

The only way to find and treat both feline hypertension and CKD is to look for

Up to 74% of hypertensive cats are azotemic due to CKD, and up to 65% of cats with CKD are hypertensive.

them. Earlier diagnoses of one or both give practitioners the opportunity to recommend early management options for a more beneficial long-term effect—on not just the length of feline patients' lives but potentially their quality of life as well.

Target Organ Damage (TOD)

The challenging part about hypertension in cats is that its presence is unlikely to be immediately apparent, unless damage to the target organs is detected at clinical presentation.

Hypertension adversely affects tissues that depend upon a rich arteriolar supply. As a result, the kidneys, eyes, brain, heart, and blood vessels are vulnerable to hypertensive injury, leading these tissues to be referred to as target organs for hypertension-induced damage.

The organ(s) affected depend on patient-to-patient variability. We simply know that higher systolic blood pressure increases the risk of TOD.

Target Organ Screening: Kidneys and Eyes

Appropriate screening protocols play a major role in comprehensive veterinary care for feline patients. With the goal of early detection and intervention to ensure better patient outcomes, it makes sense to screen the target organs that are easiest to evaluate regularly in feline patients—namely, the kidneys and eyes.

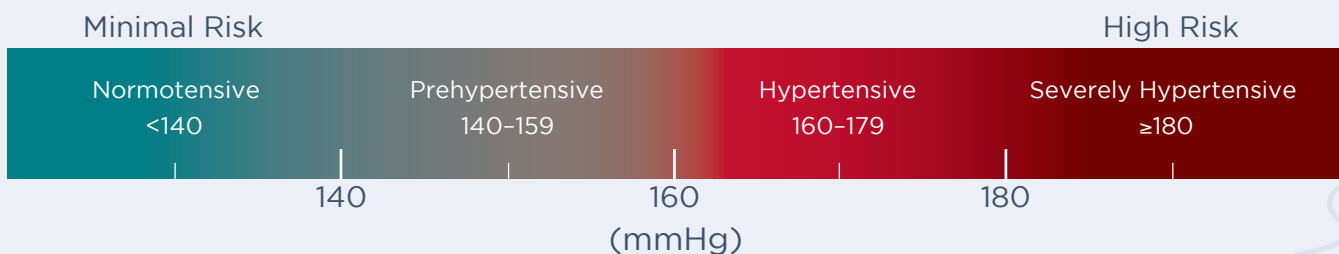
Kidneys. Chronic kidney disease is a common clinical condition in cats, many of which may not be azotemic. The condition is characterized by tubulointerstitial inflammation and has been associated with a variety of acquired and genetic factors. The results of one study indicate that 80% of cats greater than 15 years of age have CKD.¹¹ One of the earliest clinical findings in cats with CKD is weight loss.¹² Consequently, it is important to monitor changes in a cat's body weight and body condition score during regular health check examinations. There is certainly an association between systolic blood pressure and the magnitude of proteinuria in cats with CKD. This has an important therapeutic implication, since proteinuria has been linked to reduced survival in

cats with either CKD or hypertension, and may impact overall progression and survival of cats with CKD, whereas managing hypertension has not yet been demonstrated to provide a survival benefit.¹³

In addition, feline patients should be monitored through laboratory testing for evidence of CKD (increased blood urea nitrogen, serum creatinine, and/or symmetric dimethylarginine [SDMA, a biomarker for renal function] concentrations, low urine specific gravity, and increased urine protein to creatinine ratio).

Eyes. Ocular lesions occur in approximately 50% of hypertensive cats, with retinal changes developing at a systolic blood pressure >160 mmHg.^{8, 9, 14, 15, 16} This high prevalence of ocular lesions likely reflects the fact that hypertension is often identified late. Based on numerous studies in people, early detection and treatment of hypertension should prevent many of these problems in cats. Therefore, it is critical that veterinarians routinely conduct fundic examinations.

Blood Pressure Classifications and Risk for Target Organ Damage²



Signs of Hypertension by Target Organ

Ocular Signs

- Sudden-onset blindness
- Intraocular hemorrhage
- Retinal detachment
- Retinal scars
- Retinal vessel tortuosity
- Secondary glaucoma
- Hypertensive optic neuropathy
- Bilateral mydriasis

Cardiovascular Signs

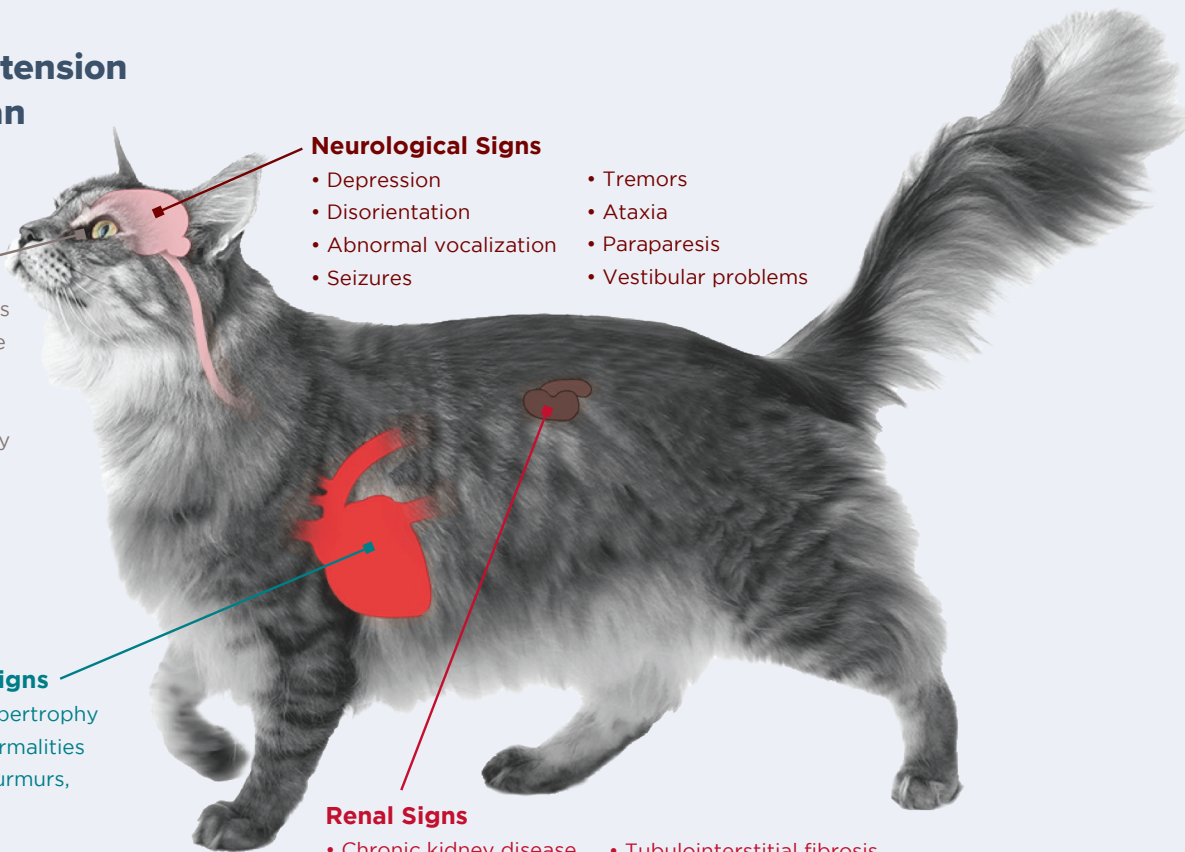
- Left ventricular hypertrophy
- Auscultatory abnormalities (gallop rhythm, murmurs, arrhythmias)
- Heart failure

Neurological Signs

- Depression
- Disorientation
- Abnormal vocalization
- Seizures
- Tremors
- Ataxia
- Paraparesis
- Vestibular problems

Renal Signs

- Chronic kidney disease
- Proteinuria
- Glomerulosclerosis
- Tubulointerstitial fibrosis
- Arteriosclerosis



Because the retina and choroid have separate blood supplies, an array of fundic abnormalities can be identified during ophthalmoscopic examinations. For example, hypertensive retinopathy can manifest as hemorrhages of varying size and number, while hypertensive choroidopathy can change the appearance of the retinal vessels. The presence of retinal edema and disruption of the blood-ocular barrier in the retinal pigment epithelium can create the impression that retinal vessels, particularly the arterioles, are narrowed. Hypertensive choroidopathy can also result in retinal detachment, which can appear bullous, flat, or involve the entire retina. In these

cases, the overlying retinal arterioles often appear more tortuous than normal, and photoreceptors often sustain irreversible damage as the result of retinal detachment.

Other ocular signs associated with hypertension include hyphema and vitreal hemorrhage; hyphema can in turn lead to secondary glaucoma.

Many cats with severe hypertensive ocular damage present with blindness and bilateral mydriasis resulting from complete retinal detachments and/or hemorrhage into the anterior chamber or vitreous; these changes are often irreversible. By

contrast, lesions that are not accompanied by an impaired menace response or an abnormal pupillary light reflex are much more amenable to antihypertensive therapy, highlighting the importance of early diagnosis. One study found that the prognosis for long-term vision in cats with hypertensive chorioretinopathy, even following complete retinal detachment, is good.¹⁷ Detection of early hypertensive ocular lesions requires an ocular examination to be performed on all cats at risk of developing lesions. This easy, noninvasive screening technique is one that most cat owners will likely approve.

Hypertension Screening and Chronic Kidney Disease (CKD)

The severity of CKD and the severity of high blood pressure in cats don't necessarily match or coordinate. In other words, practitioners can see a cat with

Because of the high-risk association between hypertension and CKD, all cats with CKD should be screened regularly for hypertension, and all cats with hypertension should be screened regularly for CKD.

early IRIS Stage 3 CKD whose blood pressure is 280 mmHg and a cat with late Stage 4 CKD whose blood pressure is holding steady at 140 mmHg.

Recommended Frequency of Blood Pressure Monitoring⁵

Age and Health Status	Frequency of Blood Pressure Monitoring
Healthy adult cats (ages 3-6)	Consider every 12 months
Healthy senior cats (ages 7-10)	At least every 12 months
Healthy geriatric cats (≥11)	At least every 6-12 months
Cats with recognized risk factors	Measure immediately and reassess at least every 3-6 months



Role of the Veterinarian

Veterinary practitioners provide the insights and leadership required to help veterinary teams and veterinary clients understand, watch for, and manage the intricacies of feline hypertension and CKD cases.

Overview of the Renin-Angiotensin-Aldosterone System (RAAS)

RAAS is a dynamic, self-regulating system that occurs in all mammals. Among other things, it controls the volume of fluid in the body. While essential in health, inappropriate and persistent RAAS activation in certain disease states, particularly in heart disease and kidney disease, may lead to worse outcomes. RAAS modulation is, therefore, a crucial part of management of these diseases.

Veterinary practitioners most often need to consider effects of RAAS in cases of congestive heart failure in dogs (a top five killer) and kidney disease in cats (number one all-cause mortality).

The RAAS plays an important role in the regulation of blood pressure, body fluid volume, and electrolyte balance. Whenever blood flow to the kidneys diminishes, renin (an enzyme) is secreted by the juxtaglomerular cells of the kidney. Renin catalyzes the conversion of the plasma glycoprotein angiotensinogen to the inactive, angiotensin I, which is rapidly hydrolyzed to angiotensin II by angiotensin converting enzyme (ACE). Angiotensin II causes vasoconstriction and sodium reabsorption (and, therefore, water too), increasing total peripheral resistance, thus increasing blood pressure. Angiotensin II also increases secretion of aldosterone by the adrenal glands. Aldosterone causes sodium and water retention, increases blood volume and thus blood pressure, enhances potassium secretion, and by this restores renal perfusion. Collectively, these responses to angiotensin II inhibit the signal for renin release.

The primary physiologic effect of angiotensin II is an increase in blood pressure.

This occurs through several mechanisms. Mainly, by stimulating specific angiotensin II type 1 receptors (AT1) in small arteries and arterioles, angiotensin II causes systemic widespread vasoconstriction that increases total peripheral resistance. Intrarenal effects of angiotensin II include an increase of the intraglomerular pressure by vasoconstriction of the efferent arteriole, and promotion of pro-fibrotic factors such as TGF- β . Collectively, the effects initiated by RAAS increase blood pressure and promote the retention of salt and water to increase the effective circulating blood volume.

Chronic, excessive RAAS activation may lead to the development of systemic hypertension and detrimental effects to the kidneys. The role of RAAS activation in the pathogenesis of hypertension in cats remains to be determined, although its involvement likely varies according to underlying etiology.^{18, 19, 20}

Based on clinical studies, there is considerable variation in the magnitude of RAAS activation in hypertensive cats. Inappropriate stimulation of the RAAS appears to be present in many, though not all, cats with CKD and hyperthyroidism, the two diseases most commonly associated with hypertension in cats.^{18, 19, 21}



A major limitation of the studies investigating the RAAS in cats so far is that the respective hormones have been measured only in the circulation and not on a tissue level. The results of studies performed in other mammals indicate that many organs, including the kidneys, heart, and central nervous system, have local, tissue-based renin-angiotensin systems that are regulated independently of the systemic RAAS.²² In cats and dogs a correlation between increased intrarenal angiotensin II concentrations and CKD has been reported.²² These local systems, particularly the one in the kidneys, have been increasingly recognized as contributors to the development of hypertension in other species. Further, lowering of blood pressure with drugs that block RAAS occurs in the absence of evidence indicating systemic RAAS activation.²⁰ Administration of some antihypertensive agents, such as amlodipine, often activates RAAS in cats.²¹





Given the pivotal role of RAAS in hypertension in cats, there is a great deal of interest in pharmacologic mechanisms through which the deleterious effects of this system can be reduced.

RAAS-Related Hypertension Treatment Options

Currently, there are two common therapeutic approaches, namely, inhibition of ACE and blockade of angiotensin II AT1 receptors.

Although ACE inhibition should reduce the synthesis of angiotensin II and prevent the ill effects of angiotensin II AT1 stimulation, this approach has some drawbacks. For example, angiotensin II also binds to another class of receptors known as angiotensin II type 2 receptors (AT2) that mediate vasodilation and the excretion of sodium in the urine (therefore also reducing circulating volume). A reduction in angiotensin II synthesis through ACE inhibition thus prevents these beneficial effects of angiotensin II. Furthermore, there is evidence that cats

treated with ACE inhibitors continue to produce excessive angiotensin II through a mechanism called ACE escape.²³ This might also explain the finding of several studies in which no blood pressure lowering effect of ACE inhibitors in hypertensive cats could be demonstrated.

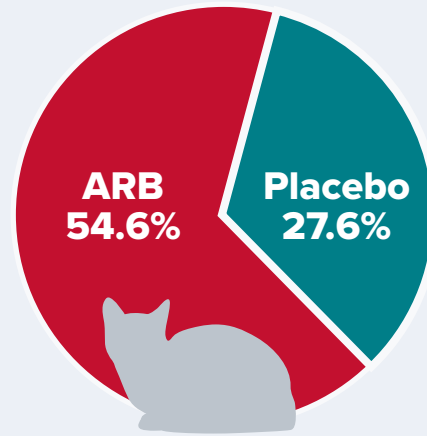
The newer therapeutic approach to reduce the deleterious effects of RAAS in hypertension is through the use of selective blockade of AT1 receptors. Drugs that work in this fashion prevent the unwanted effects of angiotensin II, namely, vasoconstriction, increased blood pressure, glomerular hyperfiltration, proteinuria, and release of pro-fibrotic and pro-inflammatory mediators, while preserving the beneficial effects mediated through stimulation of the AT2 receptors. These AT1 blocking drugs are termed angiotensin receptor blockers, or ARBs.^{24, 25, 26}

Because chronic activation of RAAS may have direct, deleterious effects on many organ systems (e.g., promotion of renal

and myocardial fibrosis), interference with this system may provide benefits beyond those occurring via reductions in blood pressure. Not only does inhibition of RAAS reduce systemic blood pressure, glomerular hypertension, and proteinuria (a suspected mediator of the progression of CKD),^{24, 27, 28} it may also provide direct antifibrotic effects that would protect both the kidneys and heart.^{25, 29} Accumulating evidence supports that antihypertensive treatments that inhibit RAAS may provide end-organ protection.²⁹

Many antihypertensive treatments for cats are extrapolated based on medications tested in humans or other species. This means that they're prescribed extralabel for feline patients. However, some researchers have completed clinical trials of specific ARBs in cats with promising results, so practitioners seeking treatment options that have been studied in feline patients may want to review clinical results to date. For example, in one double-blind, randomized, placebo-controlled clinical trial, cats receiving the ARB experienced a larger decrease in mean systolic blood pressure after 14 days compared to those receiving the placebo.³⁰ In addition, after 28 days of treatment, 54.6% of cats receiving the ARB reached the targeted blood pressure decrease (>20 mmHg) compared to 27.6% in the placebo group. Cats with systolic blood pressure over 200 mmHg and those who had already experienced ocular and neurological TOD were excluded.

Percentage of Cats Reached Targeted Blood Pressure Decrease (>20 mmHg) in 28 Days



Source: Glaus, A., J. Elliott, and B. Albrecht. "Efficacy of Telmisartan in Hypertensive Cats: Results of a Large European Clinical Trial." *Journal of Veterinary Internal Medicine* 33, no. 2 (2018): 413-422.

Updated Feline Hypertension Consensus Guidelines

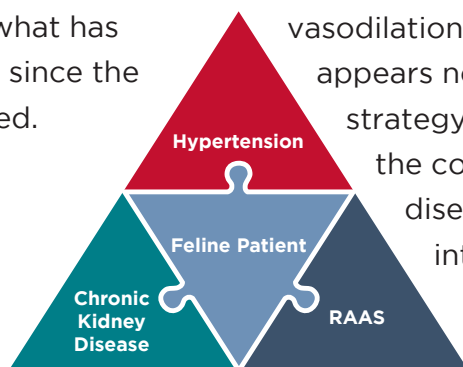
In 2017, ISFM published its updated consensus guidelines on the diagnosis and management of hypertension in cats in the *Journal of Feline Medicine and Surgery*. In 2018, the ACVIM published its own consensus statement guidelines for the identification, evaluation, and management of systemic hypertension in dogs and cats in the *Journal of Veterinary Internal Medicine*. The guidelines include detailed protocols for taking accurate blood pressure measurements, diagnosis and treatment differentials, and treatment recommendations.

Consider assigning the guidelines^{1, 2} as required reading for practitioners and veterinary teams. Both sets of guidelines

provide additional understanding, including what's known and what's still poorly understood, as well as updated recommendations based on what has been learned in the 10+ years since the prior guidelines were published.

Treatment Goals

With the growing body of knowledge about the links between CKD, hypertension, and the RAAS cascade, practitioners have additional understanding and tools for taking care



of the whole feline patient and to provide ongoing management and monitoring of concurrent diseases. Straightforward vasodilation to address hypertension appears no longer an adequate strategy, especially when considering the complex role RAAS plays in the disease. The earlier treatment can interrupt a chronically activated RAAS cascade, the better it potentially is for the patient.

Think of it like triangulating a position based on known factors.

Feline Hypertension Management Goals

<p>Screening ✓</p> <p>Screening higher-risk populations of feline patients for hypertension through regular blood pressure monitoring and ocular examinations</p>	<p>Monitoring ✓</p> <p>Persistent and gradual decrease in blood pressure to manageable levels through prescribed medications when hypertension is diagnosed</p>	<p>Prevention ✓</p> <p>Prevention, when possible, of hypertension-caused TOD</p>	<p>Mitigation ✓</p> <p>Mitigation of known concurrent diseases</p>
<p>Urinalysis ✓</p> <p>Improvement in proteinuria because of its relationship to patient survival times</p>	<p>Quality of Life ✓</p> <p>Improving the overall health and, potentially, quality of life of the cat</p>		
<p>Education ✓</p> <p>Ongoing client education and coaching to increase compliance with long-term treatment strategies, including checking compliance before changing medication dosages</p>			



Role of Veterinary Technicians and Practice Staff

Veterinary technicians and other practice staff members can provide crucial support to veterinarians, feline patients, and clients in the feline hypertension realm. When veterinary teams embrace the importance of screening cats for hypertension and educating clients on what comprehensive feline care truly means today, technicians and other team members are best suited to ask the right questions, continually educate clients, and validate clients' behavior when they take important steps to improve or manage their cats' health.

Why Measure Blood Pressure in Feline Patients?

All too often feline hypertension gets diagnosed after TOD has serious health implications. Active leadership on this issue includes recommending blood pressure checks and providing ongoing client education so that cat owners fully understand the risks of inaction and the benefits of action. In these ways,

veterinary teams can help prevent crises that can be devastating to feline patients and expensive emotionally and financially for clients.

And while scare tactics aren't the best way to educate clients, veterinary teams can lead them toward their own conclusions on how crucial the adding of hypertension screening is to the routine care they request for their felines. Antihypertensive therapy can then be initiated when necessary, preventing irreversible target organ damage.

Through their voices, experiences, connections with clients, and ability to maximize their time-on-task, veterinary technicians are best suited to become the champions of blood pressure checks by taking on these responsibilities:

- Study the functionality and practice using the practice's preferred BP check equipment.



- Calibrate and test the BP equipment semiannually.
- Integrate BP recommendations into pre-exam conversations with clients, particularly for at-risk cats.
- Create and use BP measurement protocols.
- Prioritize measurement consistency and accuracy, which provide more instructive results.
- Be the go-to people when a feline patient's BP needs to be checked (like those talented team members who are wizards at even the hardest blood draws).

Protocols for BP Checks

Measuring blood pressure in feline patients isn't always easy, and it's time consuming because it requires multiple measurements and enough time for cats to decompress from any travel stress and to acclimate to the clinic environment, including smells and sounds, etc. Ideally, BP measurements should be done before any other examinations or procedures that may also cause patient stress. The extra time spent helps mitigate the effect of situational hypertension. In addition, an emphasis on consistency in blood pressure measurement provides more accurate results. It also helps to use the smallest number of veterinary team members to check a feline patient's BP (typically two people) and to allow the cat's owner to participate, if so desired.

Through their voices, experiences, connections with clients, and ability to maximize their time-on-task, veterinary technicians are best suited to become the champions of blood pressure checks.

Both the ACVIM and ISFM consensus guidelines provide detailed protocols for completing BP checks on feline patients. Use those as a basis for useful strategies in day-to-day practice.

In addition to documenting the results of BP checks in the patient's medical record, consider documenting them on a client-friendly form that can be sent home with families as a reinforcement and validation of their commitment to their cat's health.

Blood Pressure Measurement Form

1 Patient Information

Date ____/____/____ Time ____ **AM / PM** Patient Name _____ Age ____

Gender **M / F** Others Present (Staff / Client) _____

Known Risk Factors (Circle all that apply):

>7 years / Chronic kidney disease (CKD)

Hyperthyroidism / Primary hyperaldosteronism

Hyperadrenocorticism / Pheochromocytoma

Chronic anemia / Acromegaly

Reason for Blood Pressure Check (Check one):

Routine screening

Recheck / monitoring after high BP diagnosis

2 Body Position (Select one)



Sitting



Standing



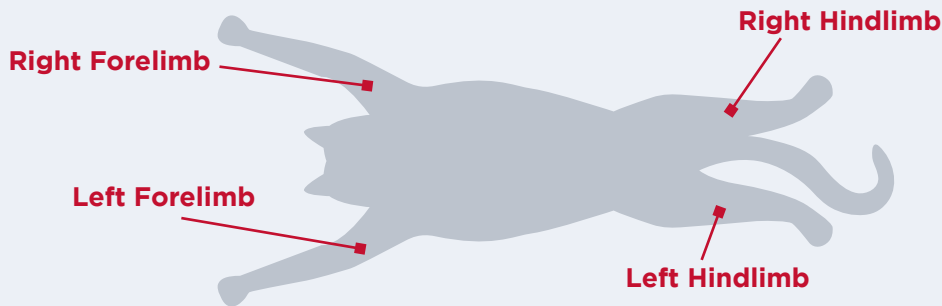
Sternal



Lateral

Other (Please specify): _____

3 Cuff Position and Equipment Used (Select one)



Equipment Used: _____ **Size of Cuff:** _____

4 Blood Pressure Measurements (mmHg)

1 _____ 2 _____ 3 _____ 4 _____

5 _____ 6 _____ 7 _____

5 Mean Systolic Blood Pressure (mmHg) (Excludes extreme highs or lows)

Techniques for Measuring Blood Pressure

In clinical practice, systolic blood pressure can be measured with reasonable accuracy in the awake cat, using one of two techniques. These are usually referred to as Doppler sphygmomanometry and oscillometry. With the recent introduction of high definition oscillometric devices, some of the shortcomings of conventional oscillometry have been overcome.³¹

When compared to oscillometry, the Doppler method has traditionally been regarded as more accurate in awake and smaller animals, as well as over lower pressure ranges. The Doppler method can provide fast and reliable measurements and has the lowest failure rate of all techniques.³² However, it requires a bit more patient restraint, and is more dependent upon operator skill, which can be obtained easily and quickly by making oneself familiar with the methodology.

In addition to providing values for systolic blood pressure, high definition oscillometry also provides diastolic and mean arterial pressure values.³¹ The latter appears to be less accurate than the Doppler technique in awake cats. Measurements acquired by high definition oscillometry can take longer to obtain than those from the Doppler technique, and are more susceptible to inaccuracies caused by patient motion. However, because the high definition oscillometry equipment



allows for visual assessment of measured pulse contours through a computer interface, such artifacts can be identified.

Ultimately, assessment of blood pressure trends over time is of greater value than consideration of measurements from a single recording session; therefore, the practice of obtaining a baseline and the repeated measurements as well as maintaining consistency in the methods utilized (e.g., standardization of cuff size and placement and patient positioning) are as important as the choice of technique. For situations in which Doppler and high definition oscillometry techniques, as well as trained personnel, are available, the choice of technique may depend on the patient's willingness to cooperate with gentle restraint and to remain motionless during the measurement process.

Cat Owner Client Education

It's easy for people with feline pets to keep putting off various elements of veterinary preventive care and screenings from year to year because their cats "seem fine." Sometimes, getting feline patients in the door at all feels like a victory.

Importance of Regular Feline Visits

Fundamentally, cat owner client education hinges on people understanding that:

- Veterinarians want to see cats of all ages even when everything seems fine. If they are indeed fine, then that's a chance to celebrate. If not, then that's potentially a chance to intervene before conditions progress.
- Cats hide illness well. They can be soldiering on with just 25% of total kidney function, for example, and no one is the wiser, unless lab work is done regularly and uncovers CKD.
- Veterinary teams can provide strategies and even pre-exam medications or therapies to make the trip to the clinic and time at the clinic itself less stressful for patients and their families.

Importance of Blood Pressure Screening

When technicians take the opportunity to discuss the addition of blood pressure screening for feline patients, the initial touchpoint conversation hinges on a few key concepts:

- Explain that the veterinary profession continues to gain greater understanding of the negative effects

of high blood pressure on cats and how finding and treating hypertension early helps prevent target organ damage and potentially improves cats' quality of life.

- Share that along with body temperature, heart rate, and respiration rate, veterinary consensus now recommends screening at-risk cats for high blood pressure as an additional vital health measure.
- Talk through how people often misread signs of high blood pressure, and the only way to know for sure is to take BP measurements regularly, especially as cats age.
- Describe the potential negative effects of undiagnosed/untreated high blood pressure on a cat's eyes, kidneys, brain, and heart, and how it can lead to crisis situations and irreversible damage.



- Explain the blood pressure check process and set expectations about what's going to happen, why several measurements are needed, and why it's done before any other examinations or procedures.
- Walk them through the most common risk factors for high blood pressure, including age (>7 years) and chronic kidney disease. Discuss other risk factors as relevant to specific feline patients, including hyperthyroidism and rare cases of primary hyperaldosteronism, hyperadrenocorticism, or pheochromocytoma.

These conversations about hypertension are especially important for feline patients who have not yet had any screening for blood pressure or possible kidney disease. Transitional phrasing such as the following can set the stage and seek permission to begin a conversation: “It looks like we have not checked urine or blood pressure on [pet’s name]. May I tell you a bit more about why we recommend looking at these health indicators?”

If clients agree to the conversation, then veterinary technicians can explain further: “Up to 74% of cats with high blood pressure have abnormalities found through blood and urine tests that reveal signs of kidney disease, and up to 65% of cats with kidney disease have high blood pressure.”

The concluding message leading into a strongly worded recommendation could sound like this: “The later we uncover high blood pressure, the greater the emotional cost for you and physiological cost for [pet’s name]. I recommend checking blood pressure today so that we can see if there is something to celebrate or something to address. Do I have your permission to do that?”

The more veterinary technicians open these conversations with clients the more confident they feel with communicating key information to help clients understand the importance of annual veterinary visits for cats and the value of preventive care routines done at those visits.

Cat Owner Client Expectations, Empowerment, and Validation

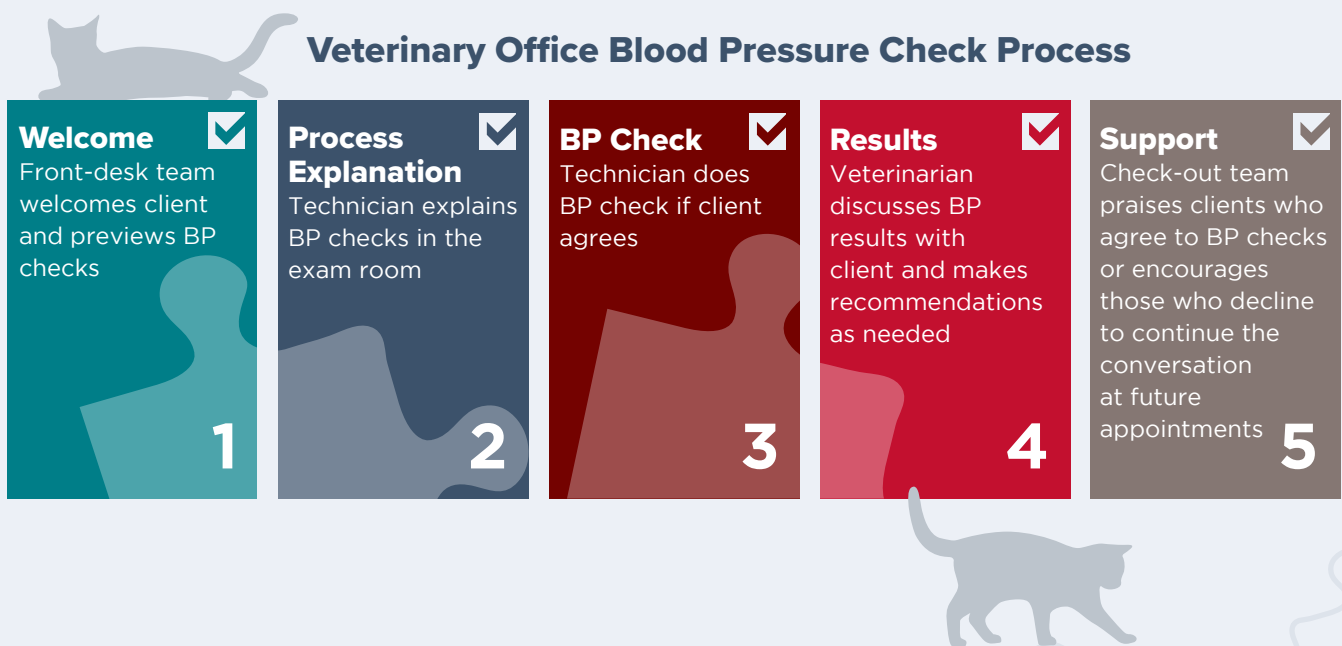
Other members of the veterinary practice team can help set expectations and introduce clients to the addition of blood pressure checks as a routine part of feline exams. For example, while welcoming the client and cat at check-in, receptionists can provide a preamble to what the veterinary technician will say in the exam room: “We now recommend blood pressure checks on all cats over age 7 [or mention whatever criteria the practice team is using]. [Technician’s name] will tell you more in the exam room, but we’re really excited to add this important health-screening measure for our feline friends.”

In addition, when interacting with cat owner clients, other practice team members can validate and empower those who do bring their cats in for regular

examinations and who agree to screenings for high blood pressure, CKD, and more:

- Tell them how nice it is to see them at every appointment.
- Thank them for being active/proactive in and about their cat’s health.
- Encourage them to keep up the good work—especially for clients managing complex diseases or difficult at-home care tasks.

Even in situations where clients decline blood pressure checks, practice team members can provide additional information to take home, offer to answer questions later as clients think of them, and let them know that the conversation can continue at future appointments. It may help to think of refusals as clients’ saying, “Not now,” instead of an all-time “No.”

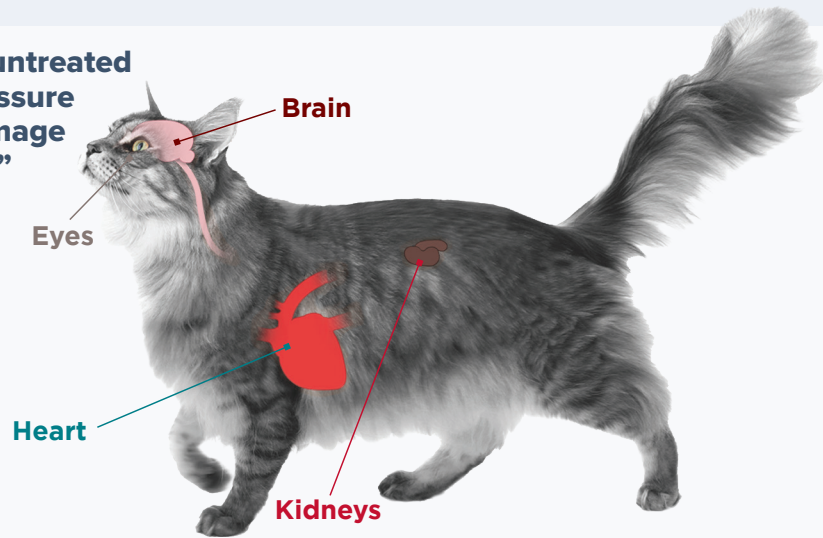


High Blood Pressure in Cats

74% Up to 74% of cats with high blood pressure have abnormalities found through blood and urine tests that reveal signs of kidney disease.⁵⁻¹⁰

65% Up to 65% of cats with kidney disease have high blood pressure.⁵⁻¹⁰

Undiagnosed/untreated high blood pressure in cats can damage “target organs”



Systolic Blood Pressure Values



Q: Why do you primarily measure systolic blood pressure and not diastolic too?

A: Because the noninvasive blood pressure measuring techniques that work on cats who are awake aren't as accurate as we'd like for diastolic values; consequently, the role of diastolic blood pressure in cats is not well established.

Two

most common risk factors for high blood pressure in cats:

- >7 years old
- Chronic kidney disease (CKD)

Recommended Frequency of Blood Pressure Monitoring⁵

Age and Health Status	Frequency of Blood Pressure Monitoring
Healthy adult cats (ages 3-6)	Consider every 12 months
Healthy senior cats (ages 7-10)	At least every 12 months
Healthy geriatric cats (≥11)	At least every 6-12 months
Cats with recognized risk factors	Measure immediately and reassess at least every 3-6 months

Feline Hypertension

Action Items

Even with the current gaps in knowledge, including the full pathology of the connections between CKD and hypertension in cats, the latest consensus is that routine screening of feline patients is an important addition to today's definition of comprehensive veterinary care and the ongoing pursuit of improving the lives of feline patients.

Consider taking these steps to integrate the latest guidelines into daily practice:

- Assign required team study of feline hypertension resources (guidelines and video content).
- Host team-wide training to discuss plans for introducing routine blood pressure checks, kidney disease screening, and ocular exams.
- Set realistic hypertension-screening goals by initially targeting feline patients at higher risk.
- Track your results and validate the team's progress.

The latest consensus is that routine screening of feline patients is an important addition to today's definition of comprehensive veterinary care and the ongoing pursuit of improving the lives of feline patients.

Feline Hypertension Additional Resources

Guidelines

"ISFM Consensus Guidelines on the Diagnosis and Management of Hypertension in Cats." *Journal of Feline Medicine and Surgery* 19, no. 3 (2017): 288–303.

"ACVIM Consensus Statement: Guidelines for the Identification, Evaluation, and Management of Systemic Hypertension in Dogs and Cats." *Journal of Veterinary Internal Medicine* 32, no. 6 (2018): 1803–1822.

ISFM Blood Pressure Measurement Videos

Doppler Blood Pressure Measurement in the Cat: Use of the Tail
youtu.be/w_HLpxLGKp8

Doppler Blood Pressure Measurement in the Cat: Use of the Leg
youtu.be/rGTLouUXUrl

Blood Pressure Measurement in the Cat: Use of HDO (High Definition Oscillometry) Equipment
youtu.be/FLkJm2ZefCo

References

1. "ISFM Consensus Guidelines on the Diagnosis and Management of Hypertension in Cats." *Journal of Feline Medicine and Surgery* 19, no. 3 (2017): 292.
2. Acierno, M. J., S. Brown, A. E. Coleman, R. E. Jepson, M. Papich, R. L. Stepien, and H. M. Syme. "ACVIM Consensus Statement: Guidelines for the Identification, Evaluation, and Management of Systemic Hypertension in Dogs and Cats." *Journal of Veterinary Internal Medicine* 32, no. 6 (2018): 1803–1822.
3. Bijmans, E. S., R. E. Jepson, Y. M. Chang, H. M. Syme, and J. Elliott. "Changes in Systolic Blood Pressure over Time in Healthy Cats and Cats with Chronic Kidney Disease." *Journal of Veterinary Internal Medicine* 29, no. 3 (2015): 855–861.
4. Elliott, J., M. Fletcher, and H. M. Syme. "Idiopathic Feline Hypertension: Epidemiologic Study." *Journal of Veterinary Internal Medicine* 17 (2003): 754.
5. Taylor, S. S., A. H. Sparkes, K. Briscoe, J. Carter, S. C. Sala, R. E. Jepson, B. S. Reynolds, and B. A. Scansen. "ISFM Consensus Guidelines on the Diagnosis and Management of Hypertension in Cats." *Journal of Feline Medicine and Surgery* 19, no. 3 (2017): 288–303.
6. Maggio, F., T. C. DeFrancesco, C. E. Atkins, S. Pizzirani, B. C. Gilger, and M. G. Davidson. "Ocular Lesions Associated with Systemic Hypertension in Cats: 69 Cases (1985–1998)." *Journal of the American Veterinary Medical Association* 217, no. 5 (2000): 695–702.
7. Littman, M. P. "Spontaneous Systemic Hypertension in 24 cats." *Journal of Veterinary Internal Medicine* 8, no. 2 (1994): 79–86.
8. Stiles, J., D. Polzin, and S. I. Bistner. "The Prevalence of Retinopathy in Cats with Systemic Hypertension and Chronic Renal Failure or Hyperthyroidism." *Journal of the American Animal Hospital Association* 30, no. 6 (1994): 564–572.
9. Syme, H. M., P. J. Barber, P. J. Markwell, and J. Elliott. "Prevalence of Systolic Hypertension in Cats with Chronic Renal Failure at Initial Evaluation." *Journal of the American Animal Hospital Association* 220, no. 12 (2002): 1799–1804.
10. Kobayashi, D. L., M. E. Peterson, T. K. Graves, M. Lesser, and C. E. Nichols. "Hypertension in Cats with Chronic Renal Failure or Hyperthyroidism." *Journal of Veterinary Internal Medicine* 4, no. 2 (1990): 58–62.
11. Marino, C. L., B. D. Lascelles, S. L. Vaden, M. E. Gruen, and S. L. Marks. "Prevalence and Classification of Chronic Kidney Disease in Cats Randomly Selected from Four Age Groups and in Cats Recruited for Degenerative Joint Disease Studies." *Journal of Feline Medicine and Surgery* 16, no. 6 (2014): 465–472.
12. Freeman, L. M., M. P. Lachaud, S. Matthews, L. Rhodes, and B. Zollers. "Evaluation of Weight Loss over Time in Cats with Chronic Kidney Disease." *Journal of Veterinary Internal Medicine* 30, no. 5 (2016): 1661–1666.
13. Syme, H. M., P. J. Markwell, D. Pfeiffer, and J. Elliott. "Survival of Cats with Naturally Occurring Chronic Renal Failure Is Related to Severity of Proteinuria." *Journal of Veterinary Internal Medicine* 20, no. 3 (2006): 528–535.
14. Chetboul, V., H. P. Lefebvre, C. Pinhas, B. Clerc, M. Boussof, and J. L. Pouchelon. "Spontaneous Feline Hypertension: Clinical and Echocardiographic Abnormalities, and Survival Rate." *Journal of Veterinary Internal Medicine* 17, no. 1 (2003): 89–95.
15. Carter, J. M., A. C. Irving, J. P. Bridges, and B. R. Jones. "The Prevalence of Ocular Lesions Associated with Hypertension in a Population of Geriatric Cats in Auckland, New Zealand." *New Zealand Veterinary Journal* 62, no. 1 (2014): 21–29.
16. Sansom, J., K. Rogers, and J. L. Wood. "Blood Pressure Assessment in Healthy Cats and Cats with Hypertensive Retinopathy." *American Journal of Veterinary Research* 65, no. 2 (2004): 245–252.
17. Young, W. M., C. Zheng, M. G. Davidson, and H. D. Westermeyer. "Visual Outcome in Cats with Hypertensive Chorioretinopathy." *Veterinary Ophthalmology* 22, no. 2 (2019): 161–167.
18. Williams, T. L., J. Elliott, and H. M. Syme. "Renin-Angiotensin-Aldosterone System Activity in Hyperthyroid Cats with and Without Concurrent Hypertension." *Journal of Veterinary Internal Medicine* 27, no. 3 (2013): 522–529.
19. Syme, H. "Hypertension in Small Animal Kidney Disease." *Veterinary Clinics of North America: Small Animal Practice* 41, no. 1 (2011): 63–89.
20. Jepson, R. E., H. M. Syme, and J. Elliott. "Plasma Renin Activity and Aldosterone Concentrations in Hypertensive Cats with and Without Azotemia and in Response to Treatment with Amlodipine Besylate." *Journal of Veterinary Internal Medicine* 28, no. 1 (2014): 144–153.
21. Fyhre, F., and O. Saijonmaa. "Renin-Angiotensin System Revisited." *Journal of Internal Medicine* 264, no. 3 (2008): 224–236.
22. Mitani, Sawane, Akira Yabuki, Kazuyuki Taniguchi, and Osamu Yamato. "Association Between the Intrarenal Renin-Angiotensin System and Renal Injury in Chronic Kidney Disease of Dogs and Cats." *Journal of Veterinary Medicine Science* 75, no. 2 (2013): 127–133.
23. Akasu, Maki, Hidenori Urata, Akio Kinoshita, Manabu Sasaguri, Munehito Ideishi, and Kikuo Arakawa. "Differences in Tissue Angiotensin II-Forming Pathways by Species and Organs in Vitro." *Hypertension* 32, no. 3 (1998): 514–520.
24. Volpe, M., C. Savoia, P. De Paolis, B. Ostrowska, D. Tarasi, and S. Rubattu. "The Renin-Angiotensin System as a Risk Factor and Therapeutic Target for Cardiovascular and Renal Disease." *Journal of the American Society of Nephrology* 13, Suppl. 3 (2002): S173–178.
25. Ruilope, L. M. "Renin-Angiotensin-Aldosterone System Blockade and Renal Protection: Angiotensin-Converting Enzyme Inhibitors or Angiotensin II Receptor Blockers?" *Acta Diabetologica* 42, Suppl. 1 (2005): S33–41.
26. King, Jonathan N., Daniëlle A. Gunn-Moore, Severine Tasker, Allison Gleadhill, and Günther Strehlau. "Tolerability and Efficacy of Benazepril in Cats with Chronic Kidney Disease." *Journal of Veterinary Internal Medicine* 20, no. 5 (2006): 1054–1064.
27. Brown, S. A., C. A. Brown, G. Jacobs, J. Stiles, R. S. Hendi, and S. Wilson. "Effects of the Angiotensin Converting Enzyme Inhibitor Benazepril in Cats with Induced Renal Insufficiency." *American Journal of Veterinary Research* 62, no. 3 (2001): 375–383.
28. Siragy, H. M., and R. M. Carey. "Role of the Intrarenal Renin-Angiotensin-Aldosterone System in Chronic Kidney Disease." *American Journal of Nephrology* 31, no. 6 (2010): 541–550.
29. Weir, M. R. "Effects of Renin-Angiotensin System Inhibition on End-Organ Protection: Can We Do Better?" *Clinical Therapeutics* 29, no. 9 (2007): 1803–1824.
30. Glaus, A., J. Elliott, and B. Albrecht. "Efficacy of Telmisartan in Hypertensive Cats: Results of a Large European Clinical Trial." *Journal of Veterinary Internal Medicine* 33, no. 2 (2018): 413–422.
31. Martel, E., B. Egner, S. A. Brown, J. N. King, A. Laveissiere, P. Champeroux, and S. Richard. "Comparison of High-Definition Oscillometry—a Non-Invasive Technology for Arterial Blood Pressure Measurement—with a Direct Invasive Method Using Radio-Telemetry in Awake Healthy Cats." *Journal of Feline Medicine and Surgery* 15, no. 12 (2013): 1104–1113.
32. Brown, S., C. Atkins, R. Bagley, et al. "Guidelines for the Identification, Evaluation, and Management of Systemic Hypertension in Dogs and Cats." *Journal of Veterinary Internal Medicine* 21, no. 3 (2007): 542–558.



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CERTIFICATE

Job Title Critical Connection in Feline Patients

Product SEMINTRA

Country United States

Job Number US-PET-0215-2020

Material Classification Technical

Material Sub-Classification

Target Audience Veterinarian

Certification:

We certify that we have examined the material referred to above, a copy of which is enclosed in the job bag and it is our belief it is:

- a) in accordance with the requirements of the relevant regulations in the country stated above
- b) where applicable, is not inconsistent with the product licence and the data sheet and
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