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High Blood Pressure

When you or I go to the doctor, one of the first things that the nurse does, after taking our temperature, is measure our blood pressure. When you take your cat to the veterinarian, however, blood pressure is not routinely measured. It is ironic that historically, the first attempts to numerically quantify arterial blood pressure were conducted in animals and yet, blood pressure monitoring has yet to become a routine veterinary procedure.

There are several reasons why measurement of blood pressure in animals is uncommonly performed. Direct measurement of arterial blood pressure is an invasive procedure, involving placement of a catheter directly into an artery, a technically difficult procedure that can be painful, and is not without complications (large bruises, potential for infection). Indirect (noninvasive) methods are more practical, however, the indirect methods require a limb containing a large artery that can be compressed by an occluding device, like a blood-pressure cuff. This can be difficult in small animals, especially those weighing less than 10 pounds, as the anatomy of the limb is such that the large arteries tend to be located higher up on the limb, where securing a cuff is difficult. Fortunately, the last decade has seen refinements in blood pressure measuring devices so that indirect blood pressure measurement is no longer the cumbersome and frustrating undertaking it once was.

There are several different techniques for indirect measurement of blood pressure. The two most common techniques are the Doppler technique and the oscillometric technique. The Doppler technique involves placing a small ultrasound probe over one of the large arteries in the limbs or the tail. An amplifier connected to the probe produces audible sounds for every pulse beat. A blood pressure cuff is placed proximal to the probe, and is inflated until the vessel is occluded and the pulse sounds can no longer be heard. The cuff is then slowly deflated. The pressure at which the pulse sounds consistently return is the systolic arterial blood pressure. In cats, Doppler readings have been found to underestimate the true systolic arterial blood pressure by about 17 mm Hg, and this should be taken into account when measurements are performed.

The oscillometric technique utilizes a blood pressure cuff to detect pressure oscillations as the diameter of the artery changes. Oscillations occur when the artery pulsates. Systolic arterial blood pressure is determined when the amplitude of the oscillations suddenly increase. With the technology now available, precise identification of the change in amplitude can be measured. A report in the September 1st, 2002 issue of the Journal of the AVMA concluded that the oscillometric method of blood pressure measurement is easily accomplished and is

fairly accurate, although it slightly underestimates blood pressure, especially as blood pressure increases.

Blood pressure measurement is important in cats because systemic hypertension (high blood pressure) has become an increasingly recognized clinical entity in cats. Chronic renal failure is the most common condition associated with systemic hypertension in the cat; approximately 20% of cats with renal failure are hypertensive. Although there are differing opinions amongst veterinarians as to the numerical definition of hypertension, most veterinarians would agree that systolic arterial blood pressure above 170 mm Hg would fit the definition of hypertension. The Veterinary Blood Pressure Society defines the average systolic blood pressure for cats as being 124 mm Hg, adding that numbers above 150 should raise some concern.

Left untreated, systemic hypertension may cause damage to a variety of tissues, the most common organs being the eyes, the heart, and the kidneys. Damage to the eyes from hypertension is well documented. As a veterinarian specializing in cats, I've seen my share of cats presenting with sudden blindness due to partially or completely detached retinas as a result of hypertension. The heart can also be damaged if hypertension remains untreated. The heart has to work extra hard in order to pump blood against a high pressure gradient. As the heart pumps harder, the heart muscle becomes thicker and less compliant. Eventually, the heart can fail, and congestive heart failure can develop. The kidneys are also susceptible to damage from high blood pressure, and cats with chronic renal failure and uncontrolled hypertension experience an accelerated progression of their kidney disease.

It is important to recognize and treat hypertension early. Cardiac changes secondary to hypertension are common, however, they are thought to be reversible if the high blood pressure is brought under control. Vision loss from hypertension rarely returns, however, so early recognition and treatment is imperative. Kidney failure is a progressive disease, however, there are indeed things that clients and veterinarians can do to slow the progression of kidney failure, and controlling hypertension is an important part of this treatment.

There have been many proposed methods of treating feline hypertension. These include administering various classes of drugs, such as diuretics, beta-blockers, calcium channel blockers, and angiotensin-converting enzyme (ACE) inhibitors. Diuretics work by increasing the filtering activity of the kidneys which decreases the blood volume, allowing for a reduction in blood pressure. Examples of common diuretics would be furosemide and spironolactone. Beta-blockers decrease blood pressure by slowing the heart rate, which reduces cardiac output and therefore the blood pressure. Propranolol was the most commonly prescribed beta-blocker in cats, however, atenolol is favored because it is more selective for the beta receptors located in the heart, and as an added bonus, it is effective at once daily dosing, as opposed to the three times daily for propranolol. (Cat owners are well aware that it is nearly impossible to consistently medicate a cat three times a day). Calcium channel blockers inhibit the movement of calcium ions into cardiac muscle as well as the smooth muscle of the blood vessels. This causes the blood vessels to dilate, lowering the blood pressure. Angiotensin-converting enzyme inhibitors hamper the production of ACE, an enzyme that leads to the production of angiotensin, a hormone that causes constriction of the blood vessels. By inhibiting this constricting hormone,

the blood vessels dilate instead, decreasing blood pressure. Angiotensin also contributes to the production of aldosterone, a hormone that increases the blood pressure. ACE inhibitors diminish the production of aldosterone, further alleviating the high blood pressure.

A few years ago, studies were published showing ACE inhibitors in combination with beta-blockers were effective in lowering blood pressure, however, other researchers have reported poor success with these drugs. In the late 1990's, researchers began to investigate the use of amlodipine (Norvasc), a calcium-channel blocker, for the treatment of hypertension in cats. This drug worked very well, and amlodipine is now considered to be the drug of choice for controlling hypertension in cats. I have had excellent success with this drug. In one memorable case, I was able to partially restore the vision in a cat with acute retinal detachments in both eyes due to hypertension after administering amlodipine.

It is imperative that cats be closely monitored once therapy has begun. Once therapy has normalized the blood pressure, it should be rechecked a minimum of every three months, and sooner if the owner notices any problems that might indicate a recurrence of the hypertension.

As you can see, advances in the recognition, diagnosis, and treatment of hypertension are now affording veterinarians the ability to prevent blindness, avoid heart failure, and slow the progression of kidney failure in our feline patients. As technology continues to improve, it can be expected that blood pressure measurement will become as routine in animals as it is in humans.