



ARTERIAL THROMBOEMBOLISM

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A Devastating Complication of Heart Disease that Strikes Without Warning

It happened in a flash. When Laura McKinnon left for the gym, "Polo", a spirited 13 year-old orange and white domestic shorthaired cat was perfectly fine. When she returned, Polo was unable to move his rear legs. His owner, Laura McKinnon, was panicked.

Upon evaluation, Polo was very agitated. His rear legs were stiff and cold, and no pulses could be detected in the arteries that supply his rear limbs.

Polo's clinical signs were very suggestive of a blood clot disrupting the flow of blood to his rear legs. Knowing that these blood clots tend to originate from a larger clot residing within the heart's left atrium, an emergency cardiac ultrasound was scheduled for Polo. Not surprisingly, a large blood clot was indeed detected in Polo's left atrium. The ultrasound also revealed Polo's primary problem: hypertrophic cardiomyopathy (HCM), the most common feline heart disorder. Cats with HCM are at risk for developing a devastating complication called arterial thromboembolism (ATE). Sadly, this is what happened to Polo.

Reviewing Hypertrophic Cardiomyopathy

Hypertrophic cardiomyopathy is the most common feline heart disease seen in clinical practice. In this condition, the walls of the left ventricle – the heart chamber responsible for pumping blood out through the aorta – become progressively thicker. This causes the chamber size to become reduced, and the ventricle to become stiffer and less compliant, affecting the chamber's ability to fill with blood. This ultimately affects the heart's ability to function normally. As a result, cats with HCM have a guarded prognosis.

There are several potential outcomes for cats with HCM. Many cats respond well to medical therapy and remain symptom-free for years. Some cats develop fatal heart arrhythmias and die suddenly. In some cats, the disease progresses steadily, ultimately leading to congestive heart failure. A significant number of cats with HCM develop aortic thromboembolism. This is one of the most serious complications associated with hypertrophic cardiomyopathy (HCM), and is one of the most common causes of hind limb paralysis in the cat.

The "hows" and the "whys" of ATE

Thrombosis is the formation of a blood clot – called a "thrombus" – which, in cats with HCM, occurs primarily within the heart's left atrium. Aortic thromboembolism occurs when a piece of this thrombus – called an "embolus" – breaks free from the main thrombus and enters the circulation. In some cases, the entire thrombus breaks free and is carried through the circulation. The thrombus or embolus eventually becomes lodged in a vessel, cutting off the blood supply to that area.

Most emboli lodge in the aorta – the biggest artery in the body – or in one of its major branches. Smaller emboli may travel into smaller arteries and affect arterial blood flow to only one limb, or to other sites such as the brain, lungs, or kidneys. The vast majority (>90%) of emboli lodge in a spot known as the aortic trifurcation – the area at the very end of the aorta where it branches off to supply the left and right rear legs and the tail. This area has also been called the “saddle” area, and a blood clot lodged in this area is commonly called a “saddle thrombus”. Cats are literally normal one second, and paralyzed in the next second.

Why do these blood clots form in the first place? In cats with HCM, the left atrium grows progressively larger as it tries to send blood into the thickened, non-compliant left ventricle. As the atrium becomes dilated, blood flow can become stagnant, increasing the risk for a blood clot to develop within the atrium. Blood flow can also become turbulent within the atrium, and this turbulence can damage to the lining of the atrium. A blood clot may begin to form at the site of the damage.

Making the Diagnosis

A diagnosis is usually based on clinical signs at presentation. Most cats present exactly the way Polo presented: acute onset of lameness, partial paralysis, or complete paralysis of the affected limbs. Physical exam often reveals an absence of femoral pulses in both legs, cold hind limbs, cyanosis (bluish coloration) of the nail beds and pads, bilateral hind limb paralysis, hypothermia (low body temperature), and in most cases, severe pain. Many of the cats with ATE show signs of shock. Virtually all cats with ATE are in obvious and considerable pain, as evidenced by excitement, frenzy, vocalization, rolling, and panting.

Most affected cats are male, although this is probably a result of the greater predisposition of male cats to develop HCM. Although any age cat can be affected, the highest occurrence occurs in cats between four and seven years old. Certain breeds, including Ragdolls, Birman, Tonkinese, and Abyssinian, appear to have an increased risk for development of ATE. Some cats with ATE have been diagnosed with HCM recently. Others may have been diagnosed with HCM months or even years before, with no clinical signs until that day. Some cats with congestive heart failure that is well-controlled may suddenly fall victim to ATE. The majority of cats with ATE, however, present without any evidence of pre-existing heart disease, just like Polo. For these cats, diagnostic tests such as cardiac ultrasound invariably confirm that there is heart pathology, and that a blood clot is indeed present within the left atrium. Today's ultrasound machines are able to evaluate arterial blood flow. During the cardiac evaluation, the ultrasound probe can be placed on the inside of the thigh to evaluate arterial blood flow to the rear limbs. Inability to detect arterial blood flow supports the diagnosis of ATE.

Initial treatment

The ultimate goal of managing the acute episode of ATE is to pull the cat through this initial critical phase. Initially, the focus is on providing rest, controlling pain, improving cardiac blood flow, and treating CHF if present. Cats that are in heart failure at the time ATE strikes may need to be stabilized using oxygen and diuretics. Restoring blood flow to the rear limbs is of secondary importance; making sure the cat survives takes center stage.

Pain control is essential, as these cats are in great discomfort. Narcotic pain relievers provide excellent analgesia and can be safely given to cats with cardiovascular disease. Improving circulation and perfusion using intravenous fluids is of paramount importance, however, this can be a challenge, in that fluid therapy must be administered cautiously in cats with heart disease.

Anticoagulants are recommended during the acute crisis. The goal, in theory, is to prevent any new thrombi from forming in the heart, and to prevent the embolus from growing in size and further reducing the blood flow to the affected region. Many cats do not survive the initial episode and they either die or are euthanized within the first 48 hours of the onset of paralysis.

More about the clot

There are drugs available that have the potential to dissolve a thrombus or embolus. Whether these drugs offer any real benefit remains controversial.

In the natural course of disease, blood flow will often resume to the affected area as the body eventually dissolves the clot on its own. Vessels in the tissues adjacent to the blocked vessel experience a gradual increase in blood flow as they learn to adapt to their injury. In addition, new vessels form, arising from the embolized vessel.

Preventing ATE

Preventing ATE is certainly an ideal and logical goal. As discussed above, it is believed that a clot forms in the heart as a result of blood stagnating in the left atrium, combined with injury to the lining of the atrium. When the inside lining of the

atrium is damaged, platelets adhere to the injured area, and the coagulation cascade begins, leading to the development of a thrombus or blood clot. Emboli that originate from the thrombus also contain platelets. Clearly, platelets play a significant role in the pathogenesis of ATE. Antiplatelet drugs are a logical choice for prevention of ATE. For years, aspirin was the drug most commonly used to inhibit platelet aggregation, however, clopidogrel (Plavix) is believed to be superior to aspirin for this purpose and is now the drug of choice in these situations.

The prognosis is guarded for cats with HCM that is complicated by ATE. In a study of 100 cats with ATE, 34% survived their initial episode. Of those that survived their initial episode and were released from the hospital, their average life expectancy was 11 ½ months. Polo survived his initial episode, however, he never regained satisfactory use of his rear legs. Despite medical therapy and aggressive nursing care at home, Polo's quality of life continued to deteriorate, and Polo was euthanized two months after his initial episode. Not long ago, Romeo, a sweet Sphynx belonging to my client Lynn Martin, also succumbed to ATE. Romeo had been diagnosed with HCM several months prior. He was stable and doing well, until stricken with acute hind limb paralysis. Given his guarded prognosis, Ms. Martin elected to take Romeo home and try nursing him through his condition. "I turned my apartment into his very own hospice care clinic. I had medication, needles, heating pads, special food... everything. He was here for about 20 hours, and then he died in my arms".

The unpredictability of HCM makes it a frustrating disorder to treat. When ATE strikes cats with HCM, the frustration factor multiplies by 100. Although there is no predicting which cats with HCM will be stricken with ATE, continued research in the areas of prevention and treatment will allow for more successful management of this devastating disease in the future.

Glossary

Thrombosis – the formation of a blood clot within the heart or blood vessels

Thrombus – a blood clot. In this article, it refers to a blood clot that has formed within the heart.

Embolus – a piece of blood clot that has broken off of the main thrombus in the heart.

Aorta – the largest artery in the body. It emerges from the heart and descends alongside the spine, giving off branches that supply other parts of the body with blood

Aortic trifurcation – the very end of the aorta, where three branches emerge, one to supply the left leg with blood, one to supply the right leg, and one to supply the tail.

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