Feline arterial thromboembolism: the clinician’s nightmare

Luca Ferasin, DVM PhD CertVC PGCert(HE) DipECVIM-CA (Cardiology) GPCert(B&PS) MRCVS
Specialist Veterinary Cardiology Consultancy Ltd, Kent, UK
luca@cardiospecialist.co.uk

Arterial thromboembolism (ATE) is characterised by the embolisation of a clot in an artery in the systemic circulation. The artery in which the clot will eventually lodge depends on the origin of the clot itself, its size and the diameter of the artery. In most cases, the initial blood clot forms inside the cavities of the left heart, particularly in the left auricle. The clot, or a fragment of it, can subsequently flow to an anatomical location in the systemic arterial circulation, normally represented by a “saddle” location at the aortic trifurcation, and subsequently compromising the blood flow in both external iliac arteries. Occasionally, emboli may travel into more distal arteries, compromising the blood flow to a single limb, including forelimbs. More rarely, ATE affects cerebral, renal, and mesenteric arteries. The majority of cats presenting with ATE have underlying heart disease, although neoplasia (hepatocellular carcinoma, pulmonary carcinoma, anaplastic carcinoma, vaccine-associated fibrosarcoma, and squamous cell carcinoma) and thyroid disease are also highly associated with ATE.

Clinical presentation

The classic clinical presentation is characterised by acute pain and paresis/paralysis of the affected limbs. The paws of the affected limb may appear pale or cyanotic depending on the severity of the local ischemia, and the limb extremity is generally colder than non-affected limbs. In most cases the “saddle” thrombus obstructs the external iliac arteries and consequently femoral pulses are weak or absent. However, if the thrombus lodges across the internal iliac arteries femoral pulses may still be palpable despite the presence of pain and hind limb paralysis/paresis.
Conversely, the femoral pulsation may be difficult to be detected in cats with shock, therefore the use of a Doppler transducer may assist the clinician in the identification of the arterial pulsation in the affected limb.

**Diagnosis**

Diagnosis of ATE can be challenging and it is usually based on history and clinical signs. In cats spending most of their time outdoors, the patient can be found recumbent on the ground and the owner’s initial thought is often towards a road traffic accident. Indeed, neurological disorders and musculo-skeletal injuries are important differential diagnoses.

In these patients, marked elevations of AST and CK are highly suggestive of ischemic damage to the limb skeletal muscles. In cats, both AST and CK have short half-lives, and their values peak at 6-12 hours, returning to normal within 24-48 hours after the acute ischemic event.

Thoracic radiographs may reveal cardiomegaly and signs of CHF (pulmonary oedema and/or pleural effusion). Echocardiography allows identification of concomitant heart disease and, sometimes, confirms the presence of a thrombus or spontaneous echo-contrast (smoke) within the heart chambers. The localisation of the thrombus can be deduced from the affected limb and, in many cases with hindlimb paralysis/paresis, where available, colour Doppler ultrasound examination of the descending aorta can be used to visualise the point of obstruction.

**Clinical management**

There is little scientific evidence and no consensus amongst clinicians regarding the ideal treatment of cats affected by ATE.

Surgical embolectomy would appear the most logical approach, but is difficult due to the size of the affected vessels and the anaesthetic risks encountered in cardiac patients. It is also an extremely unrewarding technique due to the high mortality associated with rapid reperfusion (reperfusion injury). This complex phenomenon occurs when a large ischemic area is acutely reperfused, accompanied by a violent inflammatory response within damaged tissues and leakage of cellular metabolic waste products into the circulation. Physical
Thrombolytic therapy may also appear as a rational intervention. This can be performed with pressurised saline jets to physically dissolve the thrombus (AngioJet Rheolytic Thrombectomy) with clinical outcome comparable with conventional therapies. Medical thrombolytic therapy (urokinase, streptokinase and tissue plasma activator -TPA) has shown mixed results, especially because of complications due to rapid reperfusion. In analogy with myocardial infarction in people, these expensive drugs are only effective if administered within hours of the occurrence of ischemia, which is rarely possible in veterinary patients. Conservative treatment is commonly recognised as an acceptable management for feline ATE cases, as long as pain is optimally controlled and patients undergoing treatment are properly selected. The rationale of conservative treatment is to support the patient until the development of collateral circulation to provide sufficient blood supply to the ischemic areas. The time necessary for a satisfactory clinical improvement depends on the severity of the insult and the underlying cause and may range from days to months. Euthanasia should be considered in cases of non-responsive patients (lack of clinical improvement after 2-3 days or unsatisfactory pain control) or for those exhibiting signs highly associated with a negative prognosis (severe hypothermia, multiple limbs affected with complete loss of motor function, concurrent CHF). The fact that feline ATE is a devastating clinical manifestation is undisputable. However, if euthanasia with no attempt to treat is excluded from survival analyses, the number of cats that can survive to discharge can increase up to 40-70%.

Parameters that should be evaluated to select potential survivors are:

- rectal temperature above 37.2 °C (98.9 °F)
- presence of limb motor function as evidenced by voluntary movement of limbs or positive withdrawal reflex
- absence of radiographic signs of congestive heart failure (CHF) such as pulmonary oedema, pleural effusion
- single limb affected (rather than two or more)
- absence of tachycardia (i.e. HR < 180 bpm)
- absence of hyperkalaemia (i.e. potassium < 5 mmol/l)
Of all the above parameters, rectal temperature is the strongest survival predictor, indicating that hypothermia is most likely a reflection of compromised systemic hemodynamic status rather than just local hypo-perfusion.

*Short-term, in-hospital, conservative management*

The goal of conservative treatment of ATE is to:
- guarantee adequate rest and pain relief
- reduce the risk of further thrombus formation
- improve systemic perfusion and preserve the function of the affected limbs
- control effusions in cases complicated by CHF
- provide additional support where needed

The ideal analgesic for cats affected by ATE probably depends on different patient responses, individual clinician’s experience and drug availability. However, a variety of successful analgesic drugs have been reported, including butorphanol, buprenorphine, morphine, and fentanyl. A common protocol adopted in veterinary practice is intravenous or sublingual buprenorphine administration followed by application of a fentanyl patch to allow consistent and prolonged analgesia.

Intravenous or subcutaneous unfractionated heparin (UFH) can be considered during the acute phase (hospitalisation period) due to the rapid onset of its anticoagulation properties. Conversely, intramuscularly administration of heparin should be avoided due to the risk of injection-site haematomas. Low-molecular weight heparin (LMWH) does not offer any practical advantage over UFH for short-term treatment. Cats absorb and eliminate LMWH very rapidly and therefore require higher doses and more frequent injections of the LMWH to achieve the therapeutic effects observed in human patients. It is also considerably more expensive than UFH.

Correcting systemic perfusion is a challenging task, especially in cats with signs of CHF who should never receive aggressive fluid therapy. However, if patients are not in CHF and appear dehydrated, cautious fluid therapy would certainly be indicated. Acepromazine (ACP) has been advocated for many years as a suitable drug to improve systemic perfusion in cats
with ATE. However, its hypotensive effect can also exacerbate the signs of shock and many clinicians consider the use of ACP inappropriate for cats with ATE. Similarly, external physical warming should only be performed very cautiously to avoid the risk of peripheral vasodilation and reduction of core perfusion. Little is known about the benefits of physiotherapy. Deep tissue massage of the affected areas and gentle forced movements of the affected limbs may be beneficial as long as the manoeuvre does not evoke pain or discomfort. Soft beds and gentle turning of the patient may also reduce pain and discomfort. Management of congestive heart failure is described in the previous chapter.

Cats affected by ATE are usually inappetant and nutritional support can be easily achieved via naso-oesophageal tubing in cats without respiratory distress.

**Long-term, at home, conservative management**

When the patient appears sufficiently comfortable and is regaining appetite, discharge can be discussed. The owner should be prepared to support the cat at home, including hand-feeding, grooming and toilet assistance.

Cats with an underlying cardiac disease and CHF should receive appropriate chronic treatment. Similarly, appropriate treatment should be considered in cats affected by hyperthyroidism or neoplasia.

Prophylactic anti-coagulation therapy has been debated for several years. However, at present, there is no sufficient scientific evidence to support a specific medication or protocol. Unfractionated heparin treatment requires frequent parenteral administrations to achieve consistent anticoagulation and is not generally suitable for home treatment. Oral aspirin is frequently prescribed at 75mg (“baby aspirin”) every 72h. However, a lower dose (5mg/cat/q72h) seems associated with fewer side effects and similar recurrence rate of ATE when compared to the traditional dose, although a compounding pharmacy is necessary to obtain accurate low dosing. Nevertheless, very little is known about pharmacokinetics and clinical efficacy of aspirin in preventing ATE. Clopidogrel (Plavix®, 18.75 mg/cat PO q 24h) is another inhibitor of platelet aggregation that seems to have few adverse effects in cats. It is commonly used in veterinary practice as a daily medication to prevent recurrence of ATE.
often in association with aspirin. However, at present, the clinical efficacy of clopidogrel for ATE prevention has not yet been reported.

**Prognosis**

Long-term survival is negatively affected by the concomitant presence of CHF or neoplasia. Many survivors can experience a full recovery. However, a degree of neurologic or muscular dysfunction of affected limbs may persist in some patients. Recurrence rate of ATE is relatively low (approximately 30%), although these episodes are often fatal or require prompt euthanasia. Congestive heart failure represents the most common cause of death (or euthanasia) in cats surviving acute episodes of thromboembolism (median survival time of 77 days, compared to 223 days in cats with ATE without concurrent CHF).

**Further reading**
