# Feline Aortic Thromboembolism

Assoc Prof Fiona Meyers BVSc(Hons), PhD, MANZCVS, Dip.ACVIM (Cardiology).
Veterinary Specialist Services
University of Queensland

Systemic thromboembolism is an adverse clinical outcome for which cats with underlying heart disease are at variable risk. Emboli form in the dilated left atrium according to Verchow's Triad where a combination of stagnating blood in the dilated left auricular appendage together with disease of the endomyocardium and hypercoagulobility facilitate thrombus formation. Systemic embolization of the thrombus is typically to the aortic trifurcation producing sudden onset of hindlimb paralysis. Risk is related to the left atrial size with about 75% of cats with FATE having moderate-severe left atrial dilation and only 5% of cats with no left atrial change.

Thromboembolism is a devastating sequelae of heart disease in cats. Often cats will develop congestive failure in the immediate period following thromboembolism and only 30% of cats will survive to hospital discharge. Of those cats that survive the initial episode, medial survival time is reported as 223 days for cats without concurrent congestive failure and only 77days for those with congestive heart failure[1].

## HISTORY AND PHYSICAL EXAMINATION

Often owners of cats presenting with FATE are unaware of pre-existing heart disease and the cat has been clinically well prior to developing sudden hindlimb paralysis. As such, owners often assume misadventure eg. hit by a car or fell from a height. If the owners are home at the time of the event, they witness vocalization associated with the acute ischaemic pain.

On physical examination, cardiac auscultation may be normal or abnormal (murmur, gallop or arrhythmia). Respiration may be rapid due to pain and/ or concurrent development of congestive failure. Later, tachypnoea may develop with metabolic acidosis associated with reperfusion. Pulses to the affected limbs are absent and the pads are cyanotic and cool. A nail clipped to the bed fails to bleed in affected limbs.

## PALLIATIVE/ SUPPORTIVE CARE

Analgesia is important in the immediate post-FATE period. Sensory nerve lesions become complete within several hours of the ischaemic event and so pain-relief more than 48hr after the event is unlikely to be warranted. Upon presentation, administration of butorphanol 0.1-0.3mg/kg SC, IM or IV or hydromorphone 0.1-0.2mg/kg SC, IM or IV are appropriate and should be repeated q2-4hrs until a fentanyl patch (applied at presentation) becomes active.

Monitoring in the acute post-FATE period is necessary to identify common fatal developments including congestive heart failure, reperfusion hyperkalaemia and metabolic acidosis. Continuous ECG monitoring is optimal because it allows identification of rapidly rising hyperkalaemia most sensitively (more so that intermittent serum k+ determination) facilitating treatments to reduce serum K+ (insulin, glucose) and cardio-protect (calcium gluconate), however the success of such aggressive monitoring is typically limited to ICU referral facilities. Thoracic radiographs should be performed in any tachypnoeic patient that is presumed to be pain-controlled to identify those cats developing pulmonary oedema during hospitalization.

## DEFINITIVE TREATMENT

There have been many treatments/ interventions aimed at removing the aortic thromboemboli but none have proven superior to conservative management. This is likely because thrombolytics (eg. tissue plasminogen activator, streptokinase) and mechanical clot removal methods (eg. balloon embolectomy, thrombolectomy, rotor embolectomy/thrombosuction) pose a fatal risk of reperfusion injury when thrombus removal facilitates perfusion of necrotic myocytes precipitating acute severe hyperkalaemia and sinus arrest. Mechanical techniques also necessitate high-risk general anesthesia and streptokinase poses a risk of systemic haemorrhage. Furthermore, these methods all fail to attenuate underlying cardiac disease and survivors remain at imminent risk of recurrent event. As such, definitive elimination of the thromboemboli should only be considered for patients with cerebral, splanchnic or renal infarction where rapid re-establishment of arterial flow is necessary for survival. In these patients, tissue plasminogen activator is the most appropriate therapy for thrombus dissolution.

**Veterinary Cardiologists Australia - Consulting @ VSS**

Underwood, Brisbane
(07) 3841 7011
vss@vss.net.au

Carrara, Gold Coast
(07) 5530 6370
vssgoldcoast@vss.net.au

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## ANTICOAGULANT/ ANTIPLATELET THERAPY

Medications are typically started at time of the first event in an aim to limit extension of the systemic thromboembolus and reduce the risk of repeat event.

Fractionated heparins (including dalteparin and enoxaparin) administered to normal cats have proven efficacy at clotting factor inhibition with superior safety compared to unfractionated heparin. Their small molecular size, minimally inhibits thrombin while strongly inhibiting factor Xa and they have a predictably higher bioavailabilty with longer plasma half-life than unfractionated heparin. However, pharmacokinetic studies document variable anti-Xa activity with administration of these low molecular weight heparins, and studies assessing efficacy in feline patients with spontaneous disease are lacking[2]. The disadvantage of the fractionated heparins is cost ($120-150 per week/ cat) and the need for injection by the owner subcutaneously twice daily. In the author's opinion, their value is primarily for temporary anticoagulation of hospitalized FATE cats prior to clopidogrel achieving maximal antiplatelet activity (3 days after clopidogrel commencement).

The direct factor Xa inhibitor, rivaroxaban, which is orally administered and approved for human use, has recently demonstrated predictable pharmacokinetic and anticoagulant effects in healthy cats.[3] If supported by clinical trials in cats with spontaneous disease, this drug has the potential to favourably change the treatment of feline FATE.

Clopidogrel is a platelet ADP receptor inhibitor. Pharmacodynamic studes in healthy cats demonstrate it's ability to impair platelet aggregation without the unwanted side effects associated with aspirin.[4] The FATCAT study,[5] a prospective, double-blinded, multicentre trial to assess the efficacy of clopidogrel versus aspirin to reduce thromboembolic recurrence over a 1-year study period in cats (n=72) surviving an initial thromboembolic event has recently identified that thromboembolic recurrence was more than twice as long for cats receiving clopidogrel (18.75mg SID; 443 days) compared to cats receiving aspirin (81mg PO q3d; 192 days; p=0.028). This is the first study to identify a therapeutic benefit of thromboprophylaxis for cats with feline aortic thromboembolism. Dosed at 18.75mg/ cat SID, it costs <$10/ month to the owner.

## REFERENCES

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