Volume 3 • Issue 9 • September 2017

feline focus

The International Society of Feline Medicine
Journal for Veterinary Nurses and Technicians

State of the art
Blood pressure and anaesthesia

How to...
Use erythrocyte stimulating agents

Behaviour
Understanding hoarding

Case study
A dyspnoeic cat

icatcare.org/felinefocus
UNCOVER THE HEALTH BEHIND THEIR BEAUTY

Because there are no early signs of kidney disease, regular check ups are the only way to detect CKD in its initial stages. ROYAL CANIN® provides a range of nutritional solutions adapted to IRIS stages to help support cats with CKD.

With up to 19 combinations available with different aromatic profiles and textures, there’s a Renal diet to meet every cat’s preference.
Welcome to the September edition of Feline Focus. We have an anaesthesia topic to begin with as Zara Livingstone discusses the measurement of blood pressure in anaesthetised cats. We then change topics to medicine and Rachel Korman advises on when and how to treat anaemia in cats with chronic kidney disease. This can be a difficult decision as the treatment comes with the risk of worsening the anaemia. Next, Vicky Halls covers the emotive topic of hoarding. Animal hoarders often suffer from mental health problems and need the support of multiple services to try and prevent relapse after the animals are removed. Vicky encourages us, as those working with animals, to notice and support individuals before they become animal hoarders. Finally, Russell Kenton presents a complicated case, a 6-year-old cat presenting as an emergency with dyspnoea and having suffered a seizure. Gentle cat-friendly handling is vital for dyspnoeic cats as restraint for diagnostic procedures can cause a respiratory arrest.

Don’t forget we have all your CPD needs covered with our webinars. There is one every month and if you are too busy to watch at the scheduled time, please still register as we will send you a recording. This month Louise O’Dwyer will tell us about cardiopulmonary resuscitation.

Best wishes,

Sam Taylor, Veterinary Editor

Contents

231 State of the art
A practical guide to blood pressure monitoring in the anaesthetised cat: 1

239 How to...
Using erythrocyte stimulating agents to treat anaemia of kidney disease

243 Behaviour
Understanding animal hoarding

249 Case study
Sooty: a case of sudden onset seizure-like activity
Experience the difference in your home with FELIWAY®

Comfotrs cats in the home meaning less hiding away and more time to play! FELIWAY also helps stop unwanted behaviours such as spraying, scratching and helps during stressful events such as moving home, redecorating and travelling.

PROVEN RESULTS IN 9 OUT OF 10 CATS*

VETERINARY USED AND RECOMMENDED

#1 CLINICALLY PROVEN BRAND

NEW FELIWAY® FRIENDS for conflicts between household cats

FELIWAY® feliway.co.uk

Now available!

Behaviour therapy may be required. Ask your vet or behaviourist for advice.

*Source: Mills 2001. Evaluation of a novel method for delivering a synthetic analogue of feline facial pheromone (Feliway®) to control urine spraying by cats.
A practical guide to blood pressure monitoring in the anaesthetised cat: 1

Monitoring general anaesthesia is one of the most common tasks within the veterinary practice. As well as clinical observations, a variety of electronic monitoring devices are used to improve the quality of anaesthesia. Many practices own a blood pressure monitor but do not use it to its full potential, particularly as part of routine anaesthetic monitoring. This article will discuss how and why we monitor blood pressure, its importance during an anesthetic and how to avoid pitfalls in measurement.

In the majority of circumstances, blood pressure is measured indirectly or non-invasively, which is a simple and affordable way of monitoring blood pressure. Non-invasive measurement relies on detecting the return of blood flow after temporary occlusion of an artery running to an appendage, using an inflatable cuff.

Doppler technique
Doppler flowmetry (Figure 1) involves the use of a piezoelectric crystal, which is a 10 MHz ultrasound probe that detects either arterial wall motion/red cell movement within the artery. This movement is then converted into an audible sound. The cuff is placed proximal to the probe on a limb or tail base and is inflated using a hand-held sphygmomanometer until blood flow to the distal appendage is occluded, to a pressure approximately 20–30 mmHg above this occlusion pressure. The sphygmomanometer is then slowly deflated and the cuff pressure at which the returning blood flow can be detected is noted.

There are limitations to the accuracy of readings obtained by Doppler in cats. The value obtained on the sphygmomanometer gives a...
Physiological definitions

- **heart rate (HR):** number of contractions of the heart per minute (bpm);
- **stroke volume (SV):** the volume of blood pumped from the left ventricle per beat;
- **cardiac output (CO):** volume of blood per minute:
  \[
  \text{cardiac output (CO)} = \text{heart rate (HR)} \times \text{stroke volume (SV)}
  \]
  Cardiac output is essential to ensure adequate oxygen delivery to tissue, this will only occur if there is also an appropriate driving pressure.
- **systemic vascular resistance (SVR):** the resistance that must be overcome to propel blood through the circulatory system;
- **arterial blood pressure (ABP):** the pressure exerted by circulating blood upon the walls of the blood vessels:
  \[
  \text{arterial blood pressure (ABP)} = \text{cardiac output (CO)} \times \text{systemic vascular resistance (SVR)}
  \]
  Blood pressure is required to propel blood that is ejected from the heart, through high resistance vessels in order to supply oxygen to tissues, such as the heart, brain and kidneys. Blood pressure values are expressed as three measurements and in units of millimetres of mercury (mmHg) (below and Table 1);
- **systolic arterial blood pressure (SAP):** the pressure exerted by the blood as the left ventricle contracts;
- **diastolic arterial blood pressure (DAP):** the pressure exerted by the blood within the vessel when the ventricle relaxes;
- **mean arterial blood pressure (MAP):** the average blood pressure over a single cardiac cycle:
  \[
  \text{MAP} = \text{DAP} + 1/3 \times (\text{SAP-DAP})
  \]
  The MAP is calculated in this way because systole usually occupies one-third of the cardiac cycle and diastole two-thirds.

### Table 1: Blood pressure reference intervals in cats

<table>
<thead>
<tr>
<th>Measuring with oscilometry and direct/invasive</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic arterial pressure</td>
<td>90–160 mmHg</td>
</tr>
<tr>
<td>Diastolic arterial pressure</td>
<td>50–90 mmHg</td>
</tr>
<tr>
<td>Mean arterial pressure</td>
<td>70–100 (60 minimum) mmHg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measuring with Doppler flowmetry</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Doppler flowmetry</td>
<td>80 mmHg</td>
</tr>
</tbody>
</table>

**Note:** When using a Doppler please be aware this is giving a blood pressure reading somewhere between the mean and systolic in cats, unlike in dogs, where it measures systolic only, hence the slightly lower acceptable value in cats.

The diastolic pressure is often noted in humans as the point when the flow can no longer be heard, but can be more difficult to determine in our small animals depending upon much more subjective interpretation.

It is extremely important that the anaesthetist understands the pitfalls in monitoring devices, as the interpretation requires a first assessment on whether the numbers generated are real or not.
The accuracy of this method depends on a number of factors:

- **size of the vessel:** the size and the amount of flow passing through the vessel will affect the reading:
  - at lower pressures in small arteries with a lower flow, flow is likely to be detected later and thus underestimate the true reading;
  - vasoconstricted states, such as use of medetomidine or hypothermia, may increase blood pressure, but reduce flow, making it difficult to detect a pulse;
- **inter-user variability:** experienced users generally have a better ear for detecting change in pitch associated with returning pulses;
- **environmental interference:** changes in the environmental noise depending on where in the building the blood pressure is taken. Any strong electromagnetic field can interfere with the Doppler (eg, electric heat blankets, mobile phones) and is audible as pulsatile crackling/constant background hissing. Some have suggested the use of headphones improves accuracy by 5 mmHg.

### Tip
Avoid trying to hear the pulse first and tape the ultrasound probe on at the same time. Instead, clip the hair over the area where you wish to place the Doppler probe, apply copious amounts of ultrasound gel to the Doppler probe and, without turning the machine on, firmly tape the Doppler probe to the appendage where you believe the artery will be located. Then turn the Doppler machine on and you should be able to hear a clear audible pulse. Now attach the cuff and continue.

### Helpful hints for Doppler technique
- The cuff width should be 40% of the circumference of the appendage. If the cuff is too large, the reading will be falsely low, and if it is too small the reading will be falsely high.
- The mark on the cuff should be aligned over the artery.
- Clip the hair overlying the target artery. If using a Doppler probe:
  - antebrachium: clip the palmar aspect of the metacarpals;
  - distal pelvic limb: clip the plantar surface of the metatarsals;
  - tail base: clip from the tail’s ventral midline just distal to the intended cuff site.
- The target artery must lie distal to the cuff.
- The cuff should not be completely occlusive but just tight enough so there is no room to insert a finger between the cuff and the patient’s extremity.
- When using a Doppler, apply copious amounts of acoustic gel to the clipped site and to the probe. Consider using headphones to minimise ambient noise.
- The timing between measurements using both Doppler and oscillometry is important. If the interval is too short the blood flow through the artery can become impaired, which leads to lowered blood pressures on subsequent measures. Cycling should be set to 3–3.5 mins to avoid this.
- If you get an abnormal reading, the most appropriate action is to take another reading immediately to assess validity of measurement.
- Always disregard the first reading.
and practice for its cost:use ratio, and has a big advantage of being able to audibly monitor the pulse. However, it can be labour intensive and, in some situations, be difficult to get an accurate measurement. However, I believe its benefits far outweigh its negatives and with good practice it can be an extremely useful tool.

Oscillometry
An oscillometer is an automated version of the sphygmomanometer (Figure 2). An inflatable cuff, of appropriate size, is placed on an appendage. A microcompressor in the monitor controls and measures inflation and deflation of the cuff. This detects oscillations in the blood vessel walls, the changes in wall diameter during the cardiac cycle and therefore can report SAP, at initial increase in oscillation size, DAP, at plateau of decrease of oscillations, and MAP, at maximal oscillation amplitude (Figure 3). Pulse rate is usually determined as well.

This is also non-invasive, less labour intensive and most can be programmed to take regular readings, however, the cost of the monitor can be more expensive. The accuracy of this device can again be affected by many factors:
- It does not work well in the presence of arrhythmias, slow pulse rates or low blood pressures because it relies on rhythmic arterial pulsations.
- It gives only intermittent readings which are retrospective by the time the machine displays the readings.
- It can sometimes give erroneous values, although the trend in readouts should reflect the real situation.

These devices are commonly prone to reliability issues in small patients, such as cats, as the machine struggles to pick up pulse. However, some newer veterinary specific machines claim to work accurately on cats such as the high definition oscillometer (HDO).

High definition oscillometer
This is a relatively new oscillometric device (Figure 4) that functions similarly to the traditional oscillometers. However, it differs in the way in which the cuff is deflated. Traditional oscillometers deflate the cuff in increments of 2-5 mmHg and
thus may ‘miss’ sensing the pulse at specific times. The high definition oscillometer (HDO) deflates the cuff linearly and thus should avoid missing different pulse amplitudes and, hence, be more accurate. It also has the benefit of visualising the pulse curve by connecting the machine to a computer, which would allow assessment for accuracy and artefacts (Figure 5).

It still suffers from some of the same issues as the traditional oscillometers, such as artefacts from muscle fasciculations or movement,

**Tips**

For accuracy when using HDO:
- use the correct size cuff;
- ensure the correct positioning of the appendage in relation to the base of the heart.
  - if the appendage is significantly higher than the heart the reading will be falsely low;
  - if the appendage is significantly lower than the heart the reading will be falsely high.

but visualising the pulse pressure curve will determine accuracy and whether to believe it is a true reading and the machine can be set
to a high level of sensitivity to pick up small vibrations, such as in cats with small arteries (Figures 6 and 7).

**Direct blood pressure (invasive)**

Invasive blood pressure is the gold standard for blood pressure monitoring because it allows real time, continuous information on the current cardiovascular situation. An indwelling catheter will need to be placed in a peripheral artery, such as the dorsal pedal or the coccygeal artery in the cat. The cannula is connected to a pressure transducer via non-compliant tubing containing heparinised saline which is in turn connected to a fluid bag that is pressurised to 300 mmHg. This

### Fast flush test

- Pressurise the bag to 300 mmHg.
- Ensure no air bubbles are in the system by flushing thoroughly.
- Connect to the patient arterial cannula.
- Activate the fast flush located near the transducer.
- The arterial waveform, if optimally damped, will have a flat elevated line while flushing and when the flush is released there will be one-and-a-half immediate oscillations before the arterial waveform returns as normal (Figure 8).
- If there are excessive oscillations prior to the waveform returning, the system is under-damped and thus the SAP will be over-estimated (Figure 9a).
- If there are no oscillations and the line sluggishly slopes and returns to produce the waveform then the system is over-damped and thus the SAP will be under-estimated (Figure 9b).
- You can also gain evidence of over- or under-damping by looking at the ABP trace carefully (Figure 9c).

![Figure 8: Following a system flush, the amplitude ratio of two consecutive resonant waves are calculated by dividing the smaller amplitude by the larger. This should be equivalent to 1.5 oscillations following the flush before returning to the normal blood pressure trace.](image)

<table>
<thead>
<tr>
<th>Amplitude ratio (A2/A1)</th>
<th>Damping co-efficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.9</td>
<td>0.03</td>
</tr>
<tr>
<td>0.8</td>
<td>0.07</td>
</tr>
<tr>
<td>0.7</td>
<td>0.11</td>
</tr>
<tr>
<td>0.6</td>
<td>0.16</td>
</tr>
<tr>
<td>0.5</td>
<td>0.22</td>
</tr>
<tr>
<td>0.4</td>
<td>0.28</td>
</tr>
<tr>
<td>0.3</td>
<td>0.36</td>
</tr>
<tr>
<td>0.2</td>
<td>0.46</td>
</tr>
<tr>
<td>0.1</td>
<td>0.59</td>
</tr>
<tr>
<td>0.05</td>
<td>0.69</td>
</tr>
</tbody>
</table>

**Figure 9:** (a) Normal, (b) over-damped and (c) under-damped waveforms. In an over-damped system, the damping co-efficient is >1
State of the art

continuously flushes the system (2–4 ml/h) to prevent clot formation. The transducer must be zeroed to ambient air and at the level of the patient’s right atrium. This will then give a continuous arterial pressure waveform and display the systolic, diastolic and mean arterial pressures as well as pulse rate.

As well as zeroing the transducer correctly the system will also need to be checked for error, such as over- and under-damping, which would lead to falsely low or falsely high readings, respectively. This test is called the fast flush test (see box).

There are a number of factors that will cause overdamping including:
• three-way taps;
• bubbles and clots;
• vasospasm;
• narrow, long or compliant tubing;
• kinks in the cannula and tubing.

These may be a major source of error, causing an under-reading of systolic blood pressure and over-reading of diastolic blood pressure. In an under-damped system, the damping co-efficient is <0.7. This

The arterial pressure waveform

Interactions between the volume and speed of blood ejected by the heart during each beat, the ability of the vascular tree to distend and accommodate this ejected volume, and the rate the blood is able to flow away from the central arterial compartment into the peripheral tissues, create the arterial pressure waveform. Thus, the arterial waveform, as well as giving us SAP, MAP, DAP and PR, can also supply information on various elements of cardiovascular physiology, such as stroke volume, contractility of the heart, degree of vasodilation/constriction of the periphery, and the volume status of the patient (Figure 10).

Key points

To decrease over-damping and ensure a more accurate system:
• ensure the catheter and tubing is non-compliant, ie, stiff;
• ensure it is free of connections and kinks;
• ensure that there are no bubbles or clots;
• ensure that the fluid is non-compressible and of low density, ie, 0.9% NaCl.

Figure 10: Information that can be gained from the arterial blood pressure trace

system will be quick to respond but will tend to overshoot and oscillate around its resting point, causing over-reading of systolic blood pressure and under-reading of diastolic blood pressure.

In an optimally damped system, the damping co-efficient will be around 0.64, which provides the best balance between speed of response and accuracy. This shows the
State of the art

Key point
Cats have poor collateral blood flow and are more prone to vascular spasm compared with dogs, and as such arterial catheters should only be maintained in the feline patient for 6–8 h.

Disadvantages of using the direct blood pressure measurement
• cost of the monitor and equipment;
• the user needs to be able to interpret the waveform;
• skill is required for placing an indwelling arterial cannula.

Potential complications for placement of an indwelling arterial cannula include:
• trauma;
• haematoma;
• necrosis;
• emboli;
• infection; and
• damage to peri-arterial structures.

Conclusions
Monitoring an anaesthetic is an essential tool to enhance safety. It is essential to know how to use and interpret the results presented. Monitoring blood pressure will help prevent or treat significant hypotension which, if prolonged and uncorrected, will cause reduced tissue perfusion with the potential for end-organ damage.

Further reading

Key point
Cats have poor collateral blood flow and are more prone to vascular spasm compared with dogs, and as such arterial catheters should only be maintained in the feline patient for 6–8 h.

Disadvantages of using the direct blood pressure measurement
• cost of the monitor and equipment;
• the user needs to be able to interpret the waveform;
• skill is required for placing an indwelling arterial cannula.

Potential complications for placement of an indwelling arterial cannula include:
• trauma;
• haematoma;
• necrosis;
• emboli;
• infection; and
• damage to peri-arterial structures.

Conclusions
Monitoring an anaesthetic is an essential tool to enhance safety. It is essential to know how to use and interpret the results presented. Monitoring blood pressure will help prevent or treat significant hypotension which, if prolonged and uncorrected, will cause reduced tissue perfusion with the potential for end-organ damage.

Further reading

ISFM is pleased to offer two qualifications in feline veterinary nursing:

ISFM Certificate in Feline Nursing
ISFM Diploma in Feline Nursing

Do you want to be a feline friendly nurse?
Do you want to learn more about cats?
Do you want to study from home?

Now you can!
The courses are online with workbooks to complete and marked by our experts.
For full details go to: www.icatcare.org/learn

Modular assessment. No final exam. No panic.
No reason not to enrol!
How to...

Using erythrocyte stimulating agents to treat anaemia of kidney disease

Anaemia is common in cats with chronic kidney disease (CKD), with severity proportional to the stage of CKD. Anaemia may result from deficient erythropoietin (made in the kidney), or for other reasons. Cats with a haematocrit less than 20% and showing clinical signs of anaemia (lethargy, weakness, inappetence) may benefit from treatment with recombinant human erythropoietin analogues. However, adverse effects are possible, including pure red cell aplasia. Using darbepoetin may reduce this risk. Iron supplementation should be provided and cats receiving darbepoetin or epoetin should be closely monitored.

Approximately 30–65% of cats with chronic kidney disease (CKD) develop anaemia. The severity of the anaemia is generally proportional to how severe the kidney disease is. How the anaemia severity affects a cat’s survival is unclear; however, moderate-to-severe anaemia is likely to negatively impact on quality of life.

Why do cats with CKD develop anaemia?
Erythropoietin (EPO) is a hormone produced by the cells of the kidney in response to hypoxia and it stimulates the bone marrow to produce new red blood cells. Several mechanisms may contribute to anaemia in cats with CKD (see box), when investigating a cat with CKD and anaemia, all possible causes of anaemia should be addressed.

Key point
Erythropoietin (EPO) is produced by the kidneys and stimulates red cell production. Deficient EPO may result in anaemia in cats with CKD, although other causes may contribute (eg, anaemia of chronic disease or gastrointestinal bleeding).

Anaemia of kidney disease
Anaemia of kidney disease can occur due to several mechanisms including:
- anaemia of chronic disease (due to iron sequestration);
- insufficient kidney EPO production;
- gastrointestinal haemorrhage;
- malnutrition;
- reduced red cell (RBC) lifespan due to uraemic toxins.

Rachel Korman
BVSc GPCertFelP MACVSc

Rachel Korman graduated as a veterinary surgeon from the University of Queensland, Australia, in 2000. She has worked in small animal practice in Australia and the UK. Rachel was an International Cat Care Resident at the University of Bristol, UK, and has specific interests in liver disease, geriatric medicine and feline haematological disease. Rachel currently works at Veterinary Specialist Services in Brisbane, Australia.
How to...

What signs do affected cats show?
Cats with CKD may exhibit various signs including:
• polyuria and polydipsia;
• weight loss; and
• vomiting.

However, if also anaemic clinical signs may include:
• lethargy,
• inappetence;
• weakness;
• pallor;
• dark stools or melaena;
• tachycardia;
• tachypnoea; and
• poor pulse quality.

Of course, as with all cat diseases, signs are often vague and non-specific.

Treatment of anaemia in cats with CKD
Increasing EPO levels in patients with CKD using recombinant human erythropoietin analogues (R-HuEPO) including epoetin and darbepoetin, may improve appetite and quality of life (Table 1). Both products are identical to the naturally occurring hormone in people and relatively similar (83.3%) to feline EPO. Darbepoetin (Figure 1) has a prolonged half-life meaning it needs less frequent dosing than epoetin; however, it is more expensive. In people, epoetin has largely been replaced by darbepoetin because of its increased potency and duration of action.

As human R-HuEPO differs slightly from feline EPO, a major problem with treatment is that cats may form anti-EPO antibodies. These antibodies can cross-react with the R-HuEPO agent and the cat’s own EPO, causing pure red cell aplasia (PRCA), a severe, non-regenerative anaemia. PRCA may occur in 25–30% of cats receiving R-HuEPO. The risk of PRCA developing may be less with darbepoetin compared to epoetin.

There is little published information on R-HuEPO administration in CKD cats. Most cats treated with darbepoetin responded to treatment and responders lived longer than non-responders. Concurrent disease was found more often in non-responders than in responders.
Notably, however, cats were only included in the above study if they survived longer than 56 days after treatment was instituted which may have affected these results.\(^1\)

R-HuEPO may be less effective in cats with concurrent disease causing anaemia or with more severe kidney disease. Studies are required to evaluate the effect of R-HuEPO on survival and the best time to start treatment. R-HuEPOs are considered in cats with advanced CKD and a haematocrit <20% plus clinical signs of anaemia (eg, weakness, tachycardia, tachypnoea, pallor) without an alternative underlying cause. If using R-HuEPOs, iron supplementation should also be provided (Figure 2).

Adverse effects of treatment with R-HuEPOs are possible (see box) and cats should be monitored closely, including re-assessment of packed cell volume and measurement of blood pressure (Figure 3).

### Table 1: Guidelines for erythrocyte stimulating agent administration

<table>
<thead>
<tr>
<th>Action</th>
<th>Darbepoetin</th>
<th>Epoetin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction dosage</td>
<td>0.45–1 μg/kg SC once weekly</td>
<td>100 IU/kg SC three times weekly (50 IU/kg if hypertensive)</td>
</tr>
<tr>
<td>Iron supplementation</td>
<td>Iron dextran (50 mg/cat IM monthly); or Oral iron (10-20 mg/cat elemental iron daily; ferrous sulfate 50–100 mg/cat daily)</td>
<td></td>
</tr>
<tr>
<td>Initial monitoring</td>
<td>Weekly physical examination, SBP and PCV until target achieved</td>
<td></td>
</tr>
<tr>
<td>Target PCV</td>
<td>Target PCV is 25–35% with 1–3% increase per week</td>
<td>Rapid increases in PCV should be avoided due to risk of hypertension</td>
</tr>
<tr>
<td>Maintenance dosage</td>
<td>Reduce dose by 20–25% or extend dose interval to fortnightly (darbepoetin) or twice weekly (epoetin)</td>
<td></td>
</tr>
<tr>
<td>Ongoing monitoring</td>
<td>Physical examination, SBP and CBC/PCV every 1–3 months</td>
<td></td>
</tr>
</tbody>
</table>
| Investigating treatment failure | Perform a physical examination, CBC, serum biochemistry, serum cobalamin, iron panel and consider diagnostic imaging and bone marrow sampling to identify PRCA and/or underlying causes of anaemia If no underlying disease is identified, treatment failure is likely due to anti-EPO antibody formation and ESA treatment should be stopped |}

CBC = complete blood count; EPO = erythropoietin; ESA = erythropoietin stimulating agent; PCV = packed cell volume; PRCA = pure red cell aplasia; SBP = systolic blood pressure.

Adverse effects of recombinant human erythropoietin analogues:
- polycythaemia (increased RBC counts above normal range);
- vomiting;
- iron deficiency;
- pain at the injection site;
- skin reactions;
- fever;
- joint pain;
- hypertension; and
- seizures.
Iron deficiency can occur due to gastrointestinal haemorrhage and reduced absorption or intake. Iron supplementation is recommended when commencing R-HuEPO treatment.

Anabolic steroids (eg, nandrolone cypionate, stanozolol) were historically thought to improve haematocrit, appetite and muscle mass. However, response to treatment is often minimal or absent. Stanozolol in particular is hepatotoxic in cats and anabolic steroids are no longer recommended for use in cats with CKD.

Conclusions
As with many aspects of the treatment of CKD in cats, therapeutic modalities may not necessarily prolong the patient’s life span (or data is lacking to prove these effects) but they may improve the patient’s quality of life when used appropriately.

Reference

Further reading

Online how-to videos
what all cats would want their owners to watch

Available from
www.youtube.com/icatcare
Understanding animal hoarding

Animal hoarding can cause extreme suffering to cats, given their sensitivity to overcrowding and mixing with other cats. Triggers for hoarding tend to involve loss, and a pathological grief reaction, and affected individuals may work under the umbrella of a ‘rescue’ organisation. Those working with animals should be vigilant and identify people at risk of animal hoarding before the problem develops, and work with other agencies to provide the help needed by the hoarder. Relapse is common, and early intervention desirable to reduce animal suffering.

The term ‘hoarding’ or ‘compulsive hoarding’ generally refers to the collecting of possessions that has become excessive. Hoarding is relatively common and a symptom of a variety of psychiatric or neurological conditions. However, the hoarding of animals is of particular concern as it can cause extreme suffering to those involved. Cats are particularly sensitive to overcrowding or mixing with other cats, so may suffer from many negative consequences of hoarding. Negative emotional states may be seen together with the more obvious physical results of inbreeding, neglect and poor housing.

The Hoarding of Animals Research Consortium at Tufts University defines an animal hoarder as:

‘Someone who accumulates a large number of animals; fails to provide minimal standards of nutrition, sanitation and veterinary care; and fails to act on the deteriorating condition of the animals (including disease, starvation and even death) or the environment (severely overcrowded and unsanitary conditions), or the negative impact of the collection on their own health and well-being.’

Vicky Halls is a Registered Veterinary Nurse and member of the Association of Pet Behaviour Counsellors, consulting all over the UK as a feline specialist. She works closely with International Cat Care on behaviour issues and is a bestselling author on the subject. Vicky is also a qualified person-centred counsellor and member of the British Association of Counsellors and Psychotherapists.

Almost every type of animal can be a victim of hoarding; however, cats are commonly hoarded as they are easily available and can be concealed more effectively than dogs (Figure 1). In most situations, hoarders tend to concentrate on one species. Research shows that a significant majority of hoarders are female. Hoarders will potentially be pet owners, breeders or people who work under the general umbrella of ‘rescue’, either as individuals or as part of a larger established organisation.

Not all hoarders of animals are considered the same — many have not descended to the level of living among dead or dying animals.
The Hoarding of Animals Research Consortium has subcategorised hoarders into more specific groups, referring to three main categories, based on their motivation and the potential for intervention:

- **overwhelmed caregiver**: someone with some awareness of the difficulty of the situation and therefore more receptive to help;
- **rescuer hoarder**: someone with rigid views about their level of care being better than any other and reluctant to accept help or acknowledge that anything is wrong;
- **exploiter hoarder**: someone with sociopathic tendencies and superficial charm combined with cunning and manipulative ways and no sense of guilt or remorse.

### Pathological altruism

The concept of pathological altruism gives further insight into the possible motivation of the rescue hoarder, as excessive or compulsive caregivers. Altruism would normally be considered to refer to an unselfish regard or devotion to the welfare of others. It becomes pathological, it can be argued, when the outcome has irrational or substantial negative consequences. In the case of the rescue hoarder, the following applies:

- Animals are used to support the hoarder’s own emotional needs with respect to intimacy, self-esteem, control, identity and fear of abandonment.
- A hoarder’s feeling of being a saviour of animals is not the same as actually saving those animals. Although believing they are the animals’ saviours, rescuer hoarders fail to provide for the animals’ basic life requirements.³

The failure to empathise with the needs of the animals reflects the hoarders’ inability to see the animals as separate from themselves and means that they cannot comprehend how the animals feel or understand what they need as anything different from what the hoarders require themselves. For the rescuer hoarder, their motivation is self-repair rather than a real desire to selflessly help others.

### Identifying the hoarder

The lack of adequate care for the animals is the key concern when identifying animal hoarders.
Individuals may accumulate a number of cats but care for them to a high standard by providing veterinary care and ensuring all members are neutered or prevented from indiscriminate mating in the case of cat breeders.

There comes a point where housing cats in sufficient numbers becomes detrimental to their physical and psychological health and an overwhelmed caregiver fails to monitor signs of stress or illness and therefore does not provide the adequate veterinary care. These are not necessarily cases of hoarding in the more generally understood sense, but there is a possibility that they may continue to expand their colony and fail to notice or appreciate any resulting reduction in their general level of wellbeing. Triggers for developing hoarding behaviour tend to involve loss; either of a significant and supportive relationship or a stressful change to lifestyle, health or perceived status. The reaction to this can be a complicated or pathological grief reaction with symptoms associated with fear of abandonment, similar to those experienced in post-traumatic stress disorder.

One recent study in Brazil, looking at owners with large numbers of cats (20 or more) who were caring for them adequately, showed their attachment to their pets, together with other psychological measures, had greater similarities to clinical animal hoarders than typical cat owners. The suggestion being there may be an early stage to animal hoarding, although other external factors in this case such as culture and the influence of animal control policies in Brazil must be considered.

**Consequences of animal hoarding**

The consequences for cats that are involved in hoarding cases can be severe, often involving stress associated with social overcrowding and disease, such as cat flu, ringworm, feline leukaemia virus, feline immunodeficiency virus and feline coronavirus.

The constantly increasing numbers due to indiscriminate breeding, often with closely related individuals, leads to congenital and hereditary diseases. Poor nutrition has an impact on their health and dental disease goes untreated. There are also the environmental health issues, for cats and humans, of fleas, Cheyletiella (mites), faecal contamination of all surfaces and a high level of ammonia present in the atmosphere from urine.

If cats are signed over and taken away from hoarders’ homes, many are considered to be unsuitable for rehoming due to disease or lack of socialisation. In these cases

---

**Key point**

Excessive animal hoarding can be associated with loss and the development of a form of post traumatic stress disorder.

**Key point**

The cats in hoarder’s homes usually lack the necessary early socialisation to live comfortably with humans and therefore remain inherently fearful of contact.
euthanasia is often considered to be the only appropriate welfare decision. However, there are instances where the cats are rehomed and go on to lead normal lives as pets. Unfortunately, there are no specific criteria that indicate suitability and each situation must be assessed on a case-by-case basis, putting further strain on those responsible for making these decisions.

**Don't judge the animal hoarder**

There is a temptation for many people to make a judgement about an animal hoarder as being one of three things:

- mad (mentally ill);
- bad (criminal and cruel); or
- sad (a pathetic individual).

However, judgements are rarely helpful in these cases where the ultimate goal has to be to prevent suffering in the animals and provide help, where accepted and needed, for the hoarder.

**Key point**

Everyone (family, friends, neighbours, veterinary practices, animal charities and other social agencies) has a potential role to play in any positive and constructive intervention to animal hoarding.

**Increased vigilance**

The consequences for cats of animal hoarding can be terrible, so the general public and professionals working in the pet care sector should all be vigilant and aware of the warning signs that could indicate a person has become an overwhelmed caregiver or hoarder. The person in question may feed local stray cats or street colonies and there may be a large number of cats in the vicinity. The property may be in disrepair with rubbish outside and piled against the windows, there may be a strong smell coming from it and even large numbers of flies at the windows. The owner may be known to neighbours as ‘reclusive’ and generally reluctant to let anyone in the house.

It is also apparent that private cat rescue centres or ‘sanctuaries’ may fall victim to this problem. Sadly, many well-meaning individuals will act as ‘enablers’ and support the efforts of overwhelmed caregivers running rescue centres because they are seen as people who really care and their deeds are misinterpreted as healthy altruism. The best support, however, would be to seek professional assistance and guidance for the person involved before cats suffer as a result.

Any concerns regarding the welfare of the animals in the care of any rescue facility or an individual should be raised with the appropriate authorities, for example, in England and Wales, this would be the Royal Society for the Prevention of Cruelty to Animals.

The role of the RSPCA or equivalent organisation is to advise, assist and support, together with liaison with the police and local authorities regarding any environmental health or social services involvement. Any concerns will be raised with the owner of the establishment, or the individual, and a notice of improvement may be served that is followed up after a reasonable period of time to ensure that the improvements have been carried out. If there is no improvement then
animals will be removed from the premises and evidence gathered for potential prosecution if appropriate. In all cases, the welfare of the animals is paramount and everything will be done to assist the individuals to make improvements and avoid any legal consequences.

Solution to animal hoarding
All hoarding cases deteriorate and numbers of animals increase (Figure 2) with time so the earlier positive intervention takes place the more likely the situation is to be resolved satisfactorily.

More publicity and more research is also required into this problem to find a treatment protocol for animal hoarders that takes into consideration any mental health issues; ideally, there should be a protocol that can be used before these situations become so severe that court action is necessary. Sadly, once animals have been removed, if the hoarder does not receive the appropriate psychological support, it is almost inevitable that they will acquire more animals. Reports from the USA and Australia show relapse rates of between 60% and 100%, post intervention, without psychological treatment. The priority, therefore, should be intervention at the earliest opportunity, ideally before a mental health disorder can be diagnosed. If this isn’t possible then a multi-disciplinary intervention is required that includes treatment for the hoarder’s emotional disturbances, as this is the only effective way forward to prevent further animal suffering. As the problem is so complex and multi-factorial, a great deal more research is needed.

References
4 Ramos D, da Cruz NO, Ellis SLH, et al. Early stage animal hoarders; are these owners of large numbers of adequately cared-for cats? Hum Anim Interact Bull 2013; 1: 55-69.

Further reading
2018 Calendar

International Cat Care’s much-loved charity calendar is back for another year, with a new theme – Street Cats. This A4-sized landscape calendar (opens to A3 portrait style) features images of street cats (also known of as feral cats, stray cats or community cats) from all over the world which capture the character of cats surviving without owners and reflect the reality of a life on the streets.

Available to pre-order for just £5

All proceeds go to support International Cat Care’s work in improving the health and welfare of cats worldwide.

Order yours online at: icatcare.org/shop or call +44 (0)1747 871872
Sooty: a case of sudden onset seizure-like activity

Sooty is a 6-year-old male neutered domestic shorthair who presented as an emergency with sudden onset seizure-like activity. However, on examination he started showing signs of open mouth breathing and a rapid heart rate. Immediate management of dyspnoea is vital in cats and can be life saving. This article describes the management and case work-up for a cat with severe dyspnoea.

A 6-year-old, male neutered domestic shorthair was presented out of hours with sudden onset seizure-like activity, following being found under a neighbour’s car. The cat was previously healthy, fed commercial dry diet and had outdoor access. Routine vaccination, anthelmintic and flea prevention were up to date.

Examination
Sooty was quiet, alert, aware and in average body condition (BCS 5/9). Heart rate was 240 bpm, with poor peripheral pulse quality, mucous membranes were pale and a capillary refill time of 1 s. There was rapid shallow breathing and increased respiratory effort with a respiratory rate of 60 breaths per minute and open mouth breathing. Harsh lung sounds were noted caudodorsally bilaterally.

Femoral pulses were palpable, though deemed weaker than normal, and metatarsal pulses were not palpable.

Problem list
Sooty’s current problem list includes dyspnoea, harsh caudodorsal lung sounds, tachycardia, pallor and a single seizure episode.

Emergency treatment
The cat was placed in an oxygen cage (Figure 1) and an intravenous (IV) catheter was placed. A venous blood sample was collected at time of IV placement. IV butorphanol (for sedation) 0.2 mg/kg, furosemide (as a diuretic in case of congestive heart failure) 2 mg/kg and a loading dose

Key point
It is imperative to reduce stress as much as possible in dyspnoeic cats. Avoid offering mask or flow-by oxygen if poorly tolerated, as this can increase stress and worsen the dyspnoea, even leading to death.
Case study

What can you do if you don’t have an oxygen cage?

There are a few affordable options that I recommend for practices that work really well for providing oxygen to cats in a safe and stress free manner.

Build-your-own
You will need a large clear plastic container, roughly 70–100 litres, with a lid. Make two holes in one side suitable for an anaesthetic tubing adaptor (ideally, a T-piece system), place fresh gas flow (green) tubing to adaptor. Leave one hole open for waste (exhaled) carbon dioxide. Ideally, place incontinence sheets/bedding on bottom and then cover the container to allow cat to feel safer inside. Make sure there is enough space for the cat to move around and always keep the waste hole open.

Adapt a wire carrier
You can purchase wire cat carriers enclosed within a clear, plastic casing. These are relatively inexpensive and are a good option. For example: http://www.burtons veterinary.co m/smart-oxygen-complete-kit-for-stainless-steel-basket-13404. html (Figure 1).

Further investigation
A minimum database was performed including packed cell volume/total solids, blood glucose and plasma lactate (Table 1) as well as full haematology and biochemistry (Tables 2 and 3).

Tips
When using an improvised oxygen cage:
• Lubricate eyes every hour (every 2 h when in an oxygen cage) as this makes the eyes very dry.
• Check temperature — enclosed oxygen cages can get very warm!
• Use ice packs (covered) to avoid overheating, if there is enough space.
• Offer water if clinically safe in the oxygen cage.

of levetiracetam (an anti-seizure drug) 20 mg/kg were given. After 20 mins in 100% oxygen the respiratory rate had reduced to 44 breaths per min, open mouth breathing had ceased and heart rate reduced to 210 bpm.
**Interpretation of results**

Haematology revealed a leukocytosis with a mature neutrophilia, monocytosis and eosinopenia consistent with a stress leukogram. However, infection/inflammation and neoplasia are also possible causes. A severe thrombocytopenia was identified on haematology. At this level, there is a significant risk of spontaneous haemorrhage.

Biochemistry revealed a mild increase in blood urea nitrogen consistent with a pre-renal cause such as dehydration, but underlying gastrointestinal haemorrhage cannot be ruled out at this point. The remainder of the biochemistry was unremarkable.

Hypoglycaemia as an underlying cause of the seizure-like activity is thought to be less likely at this stage. A normal haematocrit and erythrocyte panel also makes haemorrhage and anaemia less likely as a cause for this cat’s pallor.

**Table 1: Venous blood gas, packed cell volume, total solids and spot glucose results**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Results</th>
<th>Reference Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packed cell volume</td>
<td>29</td>
<td>30–50%</td>
</tr>
<tr>
<td>Total solids</td>
<td>58</td>
<td>54–84 g/l</td>
</tr>
<tr>
<td>Spot glucose</td>
<td>12</td>
<td>3.9–8.3 mmol/l</td>
</tr>
<tr>
<td>Plasma lactate†</td>
<td>2.87</td>
<td>None defined for cats (0.5–2.5 mmol/l in dogs)</td>
</tr>
</tbody>
</table>

†Plasma lactate is used as an indirect marker of anaerobic metabolism and can be a useful ancillary aid in detecting states of poor perfusion of oxygen.

**Table 2: Haematology results**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Results</th>
<th>Reference Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red blood cells</td>
<td>7.57</td>
<td>6.5–12.2 x 10¹²/l</td>
</tr>
<tr>
<td>Haematocrit</td>
<td>31.0</td>
<td>30.3–52.3%</td>
</tr>
<tr>
<td>Haemoglobin</td>
<td>10.4</td>
<td>9.8–16.2 g/dl</td>
</tr>
<tr>
<td>White blood cells</td>
<td>25.69</td>
<td>2.87–10.29 x 10⁹/l</td>
</tr>
<tr>
<td>Neutrophils</td>
<td>20.91</td>
<td>1.48–10.29 x 10⁹/l</td>
</tr>
<tr>
<td>Lymphocytes</td>
<td>3.80</td>
<td>0.92–6.88 x 10⁹/l</td>
</tr>
<tr>
<td>Monocytes</td>
<td>0.85</td>
<td>0.05–0.67 x 10⁹/l</td>
</tr>
<tr>
<td>Eosinophils</td>
<td>0.08</td>
<td>0.17–1.57 x 10⁹/l</td>
</tr>
<tr>
<td>Platelets</td>
<td>6</td>
<td>151–600 Kµl</td>
</tr>
</tbody>
</table>

**Table 3: Biochemistry results**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Results</th>
<th>Reference Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albumin</td>
<td>38</td>
<td>22–44 g/l</td>
</tr>
<tr>
<td>Globulin</td>
<td>39</td>
<td>15–57 g/l</td>
</tr>
<tr>
<td>Total protein</td>
<td>77</td>
<td>54–82 g/l</td>
</tr>
<tr>
<td>Blood urea nitrogen</td>
<td>11.6</td>
<td>3.6–10.7 mmol/l</td>
</tr>
<tr>
<td>Creatinine</td>
<td>108</td>
<td>27–186 µmmol/l</td>
</tr>
<tr>
<td>Alanine transferase</td>
<td>64</td>
<td>20–100 U/l</td>
</tr>
<tr>
<td>Alkaline phosphatase</td>
<td>23</td>
<td>10–90 U/l</td>
</tr>
<tr>
<td>Total bilirubin</td>
<td>7</td>
<td>2–10 µmol/l</td>
</tr>
<tr>
<td>Glucose</td>
<td>6.5</td>
<td>3.9–8.3 mmol/l</td>
</tr>
<tr>
<td>Sodium</td>
<td>145</td>
<td>142–164 mmol/l</td>
</tr>
<tr>
<td>Potassium</td>
<td>4.8</td>
<td>3.7–5.8 mmol/l</td>
</tr>
<tr>
<td>Calcium (total)</td>
<td>2.54</td>
<td>2.00–2.94 mmol/l</td>
</tr>
<tr>
<td>Phosphate</td>
<td>1.57</td>
<td>1.10–2.74 mmol/l</td>
</tr>
</tbody>
</table>

*Abnormal results in bold (black higher and purple lower than the reference interval)

**Key point**

A low platelet count on a machine may be due to true thrombocytopenia, or artefactual due to platelet clumping, hence why examination of a blood smear is so important.
Case study

Making blood smears

Always perform a manual blood smear (Figure 2) for anaemic animals and those with low platelet counts on the haematology machine. It is essential to work out whether thrombocytopenia is real or if it is false due to the machine miss-counting.

Figure 2: Making a blood smear

Tips

For good blood smear technique:
- **use clean stains**: avoid stains that have a lot of precipitate in, or have been used for other potentially infectious cytology (such as ear smears) as this can make interpretation harder;
- **ensure there is a feathered edge**: this is essential for looking for platelet clumping;
- **make 2–3 smears**: this allows accurate interpretation;
- **keep microscope lens clean**: ensure oil for higher magnification is in date and has no precipitate within;
- **practise**: making good blood smears comes from practising the technique, so use remains or samples from other patients (even if not clinically relevant for that case) to practise the technique with.

Next steps

A manual blood smear was performed to further assess the thrombocytopenia. This was assessed to be an absolute thrombocytopenia with ≤1 platelet observed per high power field. The feathered edge revealed no platelet clumping. Pulse oximetry revealed a saturation of haemoglobin of 93%. Non-invasive Doppler blood pressure revealed hypotension (systolic blood pressure 80 mmHg).

The cat’s condition had improved following oxygen therapy and medical treatment, however, he remained tachypnoeic with a respiratory rate of 52 breaths per minute. Further IV furosemide was given every 4 h and the cat remained in an oxygen-rich kennel for the duration of the night. Due to the high risk of stress induced desaturation thoracic radiographs were not performed at this stage.

The following morning

Following treatment and oxygen therapy overnight the cat's respiratory rate was 40 breaths per

Key point

For unstable dyspnoeic cats, ultrasound of the thorax can help make a diagnosis and avoids the stress of positioning for radiography. Pleural effusions can be identified and drained, and finding a normal left atrium can rule out cardiac failure.
minute and the harsh caudodorsal lung sounds had reduced. Heart rate was 218 bpm. A gallop rhythm and jugular distention were now noted on clinical examination. Neurological evaluation of the cat was unremarkable. Conscious thoracic radiographs were attempted now the cat was more stable to assess for intrathoracic causes of the dyspnoea (see Figure 3).

There is a mixed alveolar, interstitial pattern with air-bronchograms visible caudal to the carina on the lateral view and within the left cranial lobe on the dorsoventral view. The cardiac silhouette is globally enlarged with increased sternal contact on the lateral view and increased costal contact bilaterally on the dorsoventral view. The carina is displaced dorsally. Pulmonary vein congestion is also noted on the lateral view cranial to the cardiac silhouette. The diaphragm appears intact, and the cranial abdomen appears within normal limits. The musculoskeletal structures appear normal.

The radiographic findings are all suggestive of cardiac disease with congestive heart failure. This would explain the presenting clinical signs of expiratory dyspnoea, tachycardia, bilateral harsh lung sounds and pallor, as well as the jugular distension and gallop rhythm. However, this does not explain the seizure-like episode, nor the severe thrombocytopenia. Non-cardiogenic pulmonary oedema has been reported to occur following prolonged seizure activity; however, this would not explain the cardiac signs in this cat.

Possible differential diagnoses
At this point the most likely differential diagnoses for this cat are:

- cardiac disease:
  - hypertrophic cardiomyopathy (HCM);
  - restrictive cardiomyopathy;
  - pericardial effusion (globoid,
How can I get conscious radiographs in a dyspnoeic cat?

- **minimise stress:** keep lights as low as possible, reduce handling, keep noises down, and limit staff to only those essential;
- **have radiography equipment ready:** ensure exposure settings are set, have cassette lined up (can collimate to a stuffed cat toy) and only bring the cat through once this is ready. This can reduce the time the cat has to be handled and manipulated;
- **reduce restraint methods:** use as few aids as possible, avoid all methods of ties and reduce sandbags around the airways especially;
- **always get a dorsoventral view first:** reduces the stress of having the cat in lateral recumbency and avoids causing atelectasis of the lung fields which can confuse diagnosis;
- **use sedation if necessary:** use IV butorphanol 0.3 mg/kg if necessary as this has a relatively safe profile for sedation. Ensure the cat is breathing efficiently while sedated;
- **avoid mask/flow-by oxygen:** provide oxygen with minimal stress: mask oxygen is rarely tolerated. Flow-by could be used if the cat remains calm;
- **have resuscitation kit ready:** always have a CPR and resuscitation box/kit to hand in case a cat becomes apnoeic. Include a range of endotracheal (ET) tubes, a laryngoscope and ET ties;
- **use cat friendly techniques:** if a cat does not tolerate conscious radiographs do not force it. Either sedate (see above), put the cat back into oxygen and try again when calm, or use ultrasound to help achieve a diagnosis. Some very unstable dyspnoeic cats may need trial treatment before any diagnostic tests.

round cardiac silhouette);
- **thrombocytopenia:**
  - destructive (immune-mediated thrombocytopenia, neoplasia or drug reactions);
  - consumptive (haemorrhage, disseminated intravascular coagulopathy);
  - decreased production (bone marrow disease, infectious agents, drug reactions);
  - sequestration (splenomegaly, neoplasia, severe hypothermia);
- **seizure-like activity:**
  - **extracranial:** metabolic or toxic less likely based on biochemistry and history, traumatic cause still cannot be excluded, hypoxic episode secondary to an embolus is a major differential combined with the thrombocytopenia;
  - **intracranial:** structural lesions (neoplasia, inflammatory/infectious) cannot be ruled out at this stage;
  - **not a seizure?** other differentials could include syncope, collapse or a neuromuscular disease.

Can we tie this all together?

To further investigate the cardiac abnormalities identified on plain radiography, an echocardiogram was performed to assess for structural change to the heart.

Findings were consistent with HCM with reduced systolic function, enlarged dilated left ventricle consistent with potential left ventricular outflow tract obstruction and a generalised enlarged left atrium consistent with congestive heart failure. Additionally, a large increased echogenicity was
observed within the left atrium with a ‘smoke-like’ appearance (Figure 4).

**Final diagnosis**
Sooty has HCM with congestive heart failure. The acute onset of clinical signs suggests this has moved into the clinical, decompensated phase of the disease. There is a large thrombus lodged within the left atrium. Consumptive thrombocytopenia is the most likely explanation for the thrombocytopenia in this case, with platelets ‘used up’ in the formation of the thrombus in the left atrium. It is assumed that the seizure was the result of a blood clot travelling to the brain, or was actually an episode of syncope from poor cardiac output or an arrhythmia.

**Case summary and outcome**
The initial presenting signs of seizure-like activity, dyspnoea with harsh bilateral lung sounds, tachycardia and pallor were not specific for cardiac disease. In this case the immediate stabilisation of the dyspnoea and treatment of potential pulmonary oedema was critical prior to attempting stress inducing procedures such as thoracic radiography.

Unfortunately, following discussion with the owners, the cat was euthanased, as the prognosis was guarded and finances limited. Had the cat been treated, management of congestive heart failure with ongoing furosemide would have been indicated, along with clopidogrel (anticoagulant),1 to prevent further clot formation. Pimobendan can also be used in cases of decompensated HCM, as they may have poor systolic function and benefit from the inotropic (increased contractility) effect of this drug.2

**Key point**
In HCM the ventricular muscle thickens and limits the blood that can enter. The left atrium becomes dilated as a result, and as blood moves around this enlarged chamber, cells bump into each other forming small clots (seen as ‘smoke’ on echocardiography), or a large clot as in this case.

**References**