Anaemia in cats

Anaemia is a common clinicopathological finding in cats. Clinical signs and physical examination findings are dependent on the severity of the anaemia and the disease chronicity. Broadly, causes can be divided into regenerative and non-regenerative categories. Obtaining a definitive diagnosis is important, firstly for the formulation of an appropriate treatment plan but also to enable the clinician to provide prognostic information, likely treatment duration and estimated costs. However, cats presented for investigation of anaemia may be significantly compromised, such that administration of blood products may be required prior to performing diagnostic procedures.

Key words: anaemia, cats, feline, haematocrit, pallor, PCV.
Please see common abbreviations are at the end of the article.

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Emi graduated from the University of Bristol with a Bachelor Degree in Veterinary Science with honours in 2003. As an undergraduate she intercalated in Veterinary Pathology at the Royal Veterinary College in 2000-2001, with a research project on canine respiratory mycoplasmas. Shortly after graduating Emi became an Intern in Small Animal Veterinary Studies at Glasgow University School of Veterinary Sciences. She worked as a locum at the Queen's Veterinary Hospital for two months before working as a first opinion small animal vet first in Woodbrige, Suffolk, then in Bristol. She was awarded a PhD from University of Bristol in June 2011 for research into haemotropic mycoplasmas, an infectious cause of anaemia in animals (including humans). In 2016 she gained European Veterinary Specialist in Small Animal Internal Medicine status following a Senior Clinical Training Scholarship at University of Bristol. She is currently working as a post-doctoral research assistant on feline coronavirus genomics.

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What is anaemia?

Anaemia occurs when the RBC mass (as indicated by haemoglobin concentration, PCV, HCT, or RBC count), decreases below the laboratory reference interval. The severity of anaemia can be broadly categorised as mild, moderate, severe or very severe (Table 1). RBC production is under the control of a negative feedback loop. Erythropoietin (EPO) is secreted by interstitial fibroblasts in the kidney. In the normal state low levels of EPO are constantly secreted, with increased secretion occurring in response to falling oxygen levels. EPO acts upon erythrocyte progenitors and precursors in the bone marrow increasing red blood cell production. Increased red blood cell numbers increases oxygen carrying capacity and EPO production decreases. Reticulocytosis develops 3-5 days following an episode of haemorrhage.

NB: where haemorrhage is on-going and the patient is hypovolaemic, or if the patient is concurrently dehydrated – the PCV may underestimate the severity of disease

Table 1: Severity of anaemia, based on PCV/HCT

The red cell mass of normal cats is typically lower than that of dogs and they can often tolerate greater degrees of anaemia, particularly if chronic.

SEVERITY OF ANAEMIA	
PCV/HCT (%)	**Severity**
>25	Normal
20-25	Mild
15-20	Moderate
10-15	Severe
<10	Very severe

Causes of anaemia

Regenerative vs non-regenerative - and everything in between

Causes of anaemia can be considered, in general terms, as increased erythrocyte loss (haemorrhage), decreased erythrocyte lifespan (haemolysis) or decreased erythrocyte production (bone marrow disease). Although, for diagnostic purposes the categories of regenerative (i.e. haemorrhage or haemolysis) or non-regenerative (i.e. bone marrow disease), as defined by the degree of reticulocytosis, are more commonly used. When considering this classification, it is however important to realise that:

- Some diseases can result in both regenerative and non-regenerative forms of anaemia (e.g. FeLV-infection; idiopathic IMHA)
- Acutely affected cats may be pre-regenerative and have no evidence of reticulocytosis on haematological evaluation
- Progression from regenerative to poorly regenerative to non-regenerative states may be evident as disease progresses (e.g. chronic haemorrhage leading to iron-deficiency anaemia)
- Concurrent disease (e.g. FeLV-infection; cat flu) and drug administration (e.g. corticosteroids) may impair or delay the regenerative response

Haemorrhage

Haemorrhage may be internal or external, acute or chronic. Haemorrhage into the gastrointestinal or respiratory tracts may be detected as haemoptysis, haematemesis or melaena. The latter may also represent swallowed blood originating from epistaxis, oral bleeding or haemoptysis. External blood loss may or may not be noted by the owner. In acute haemorrhage, fluid and protein are lost in addition to red blood cell mass,

resulting in hypovolaemia and, once volume corrected, panhypoproteinaemia. In chronic haemorrhage (e.g. heavy flea burden; chronic gastrointestinal haemorrhage), iron and protein may be lost from the body, resulting in iron deficiency and hypoproteinaemia.

Haemolysis

Haemolysis may be intravascular or extravascular, acute or chronic. Immune mediated haemolysis can be idiopathic or secondary to another disease process (e.g. haemoplasmosis, FIP, lymphoma). However, not all causes of haemolysis are immune-mediated. For example, feline RBC are particularly sensitive to oxidative damage, which can lead to increased RBC fragility. When intravascular haemolysis occurs, haemoglobinaemia and haemoglobinuria may be evident whilst hyperbilirubinaemia and bilirubinuria may be present in extravascular haemolysis.

Bone marrow disease

A lack of bone marrow response to anaemia can occur because of reduced EPO release by the kidney, suppression of bone marrow precursor response to EPO, relative or absolute lack of iron required to synthesise haem, damage to RBC precursors (e.g. due to immune-mediated, toxic, or infectious disease), replacement with dysplastic or neoplastic cells, or replacement with scar tissue. Some cats have a non-regenerative anaemia, with a positive Coombs' test, no identifiable underlying trigger and respond to corticosteroids. These are often described as having non-regenerative IMHA. Bone marrow cytology in such cases typically documents presence of a precursor-directed attack.

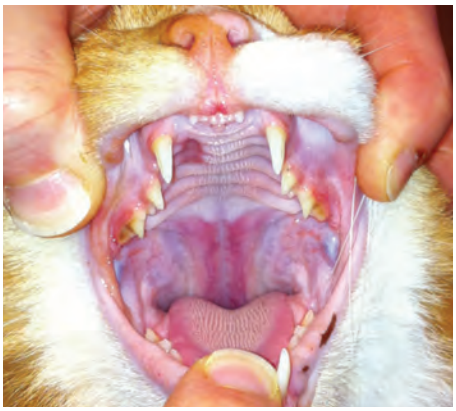

Figure 1: Right-sided palatine ulcer, which may result in marked haemorrhage if the palatine artery is eroded (a.k.a. Menrath's ulcer). Commonly associated with over-grooming secondary to allergic skin disease. Management comprises removal of allergic triggers, e.g. effective flea treatment, and in some cases ligation of the palatine artery on the affected side.

Table 2: Differential diagnoses

REGENERATIVE		
HAEMORRHAGE		
Traumatic	(e.g. road traffic injuries leading to splenic or hepatic lacerations and haemoperitoneum; pelvic fracture)	
Spontaneous	Underlying structural lesion	Gastrointestinal ulceration: • Neoplasia (e.g. intestinal lymphoma; mast cell tumour; gastrinoma) • Inflammation (e.g. inflammatory bowel disease) • Uraemia (e.g. chronic kidney disease) • Non-steroidal anti-inflammatory drug (NSAID) administration
		Urogenital
		Neoplasia
		Oral ulceration (e.g. Menrath's palatine ulcer) (Figure 1)
		Organ rupture (e.g. systemic amyloidosis in Siamese cats and related breeds)
	Haemostatic disorder	Platelet disorder: • Thrombocytopenia - Idiopathic immune-mediated thrombocytopenia - Bone marrow disorder (see below, as per bone marrow disorders resulting in non-regenerative anaemia) • Thrombocytopathia (e.g. NSAID/aspirin toxicity; Von Willebrand's disease)
		Disorder of secondary haemostasis: • Congenital (e.g. haemophilia) • Acquired (e.g. rodenticide toxicity; severe hepatic dysfunction)
	Parasitic (e.g. severe infestation of fleas, *Ctenocephalides felis*, particularly in kittens)	
HAEMOLYSIS		
Immune-mediated	Primary (i.e. idiopathic) IMHA	
	Secondary	Infectious (e.g. haemoplasmosis, typically *Mycoplasma haemofelis*; FeLV-infection; FIP)
		Toxin / drug: • Antithyroid medication (e.g. methimazole, carbimazole) • Antibiotic (e.g. trimethoprim sulphonamide)
		Neoplasia (e.g. lymphoma)
		Blood transfusion-associated
		Neonatal isoerythrolysis
Heinz body anaemia	(e.g. onion ingestion, often via baby food, soup or pasta sauce; paracetamol toxicity; diabetic ketoacidosis; lymphoma)	