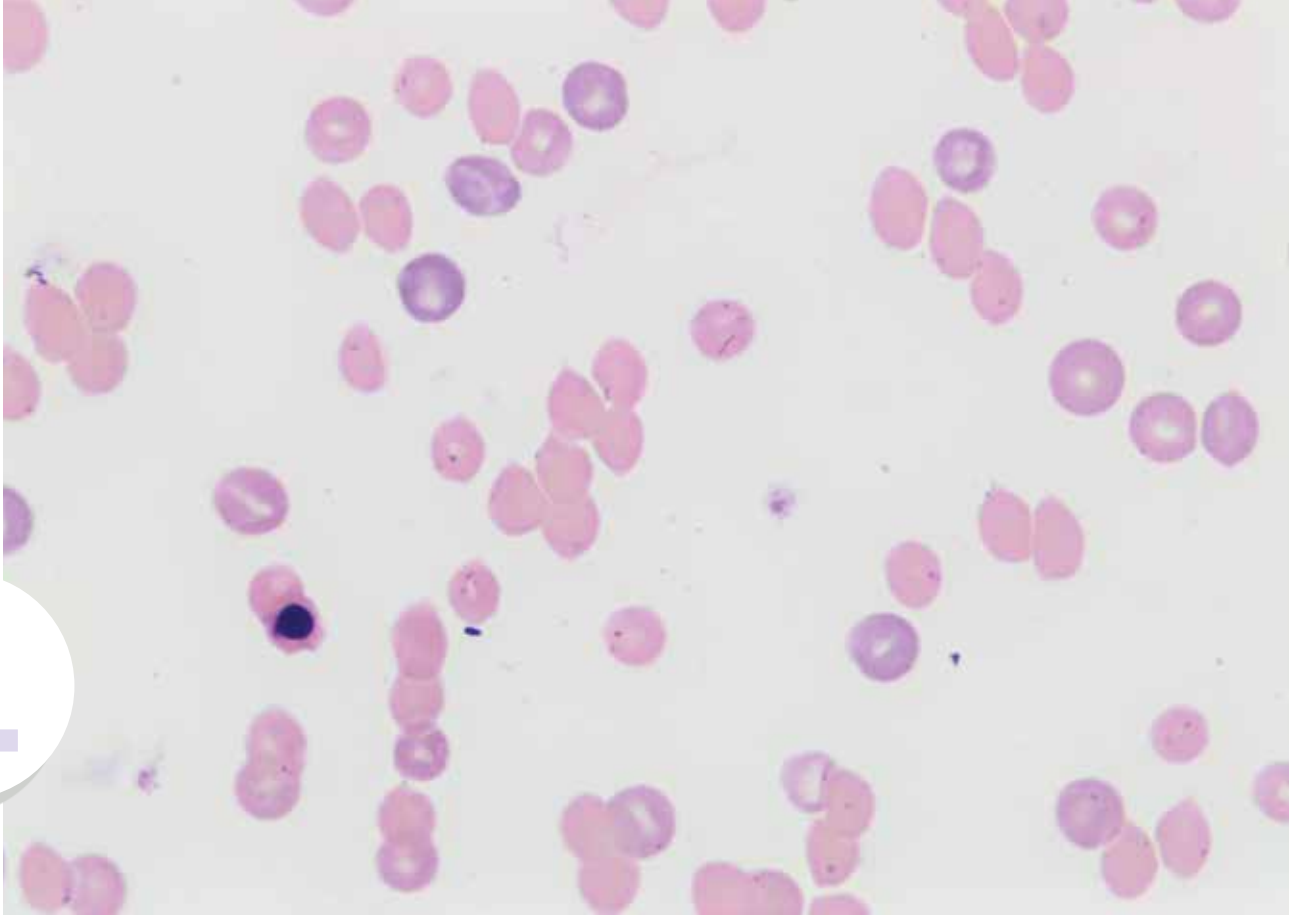

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Haematology challenge

Amy Weeden, Gribbles Veterinary Pathology, Auckland, discusses
two cases of cats presenting with anaemia and icterus.

ABOVE AND RIGHT are two photomicrographs and associated laboratory data from cats presenting to their veterinarians with anaemia and icterus. Image/Case 1 is a 10-year-old female domestic shorthair that had been missing for five days. Image/Case 2 is a one-year-old male ragdoll with lethargy.

Three questions arise:

1. In each case, what is the etiology of the anaemia?
2. What are the associated abnormalities visible in the blood smear?
3. How might you explain the changes seen in the laboratory data?

To answer the first, the etiology is haemotropic *Mycoplasma* infection in both cats. Many of the red cells contain small, basophilic inclusions of uniform size, which are sometimes found in distinct chains. The morphology of the inclusions is consistent with haemotropic *Mycoplasma spp*.

As for associated abnormalities, both smears include a thin red cell density (consistent with decreased red cell volume/anaemia), anisocytosis and polychromasia (variation in red cell size and blue tinge consistent with a regenerative response) and nucleated red blood cells (also consistent with regeneration). Also visible in Case 2 are occasional erythrocyte ghosts, some of which have attached organisms, a sign that intravascular haemolysis has occurred. There is also marked agglutination in this smear, indicating an immune-mediated component of disease.

What might explain the changes in the laboratory data? Complete blood count (CBC) data is supportive but not specific for the disease. Regenerative anaemia is expected in cases of haemolytic disease and is indicated by decreased red blood cell (RBC) count, haemoglobin (Hgb) and haematocrit (HCT)/packed cell volume (PCV) with an increase in reticulocyte count. A pattern that may be seen with marked regeneration is a decrease in mean cell haemoglobin concentration (MCHC) and an increase in mean cell volume (MCV), as immature erythrocytes have less haemoglobin and are larger than mature erythrocytes. Case 1 has a macrocytosis. The red cell distribution width may

TABLE 1: CBC abnormalities

Parameter	Units	Case 1	Case 2	Reference interval
RBC	X 1,012/L	1.39	Unavailable*	4.8-9
Haemoglobin	g/L	38	40	80-140
HCT/PCV		0.12	0.12	0.24-0.45
MCV	fL	87	Unavailable*	39-56
MCHC	g/L	313	Unavailable*	290-340
Absolute reticulocyte count	X 109/L	218.23	Unavailable*	0-50
Reticulocyte percentage	%	15.7	4.6	
nRBC	Number/100 leukocytes	62	35	0
Band neutrophil count	X 109/L	0.1	0.4	0-0.3
Lymphocyte count	X 109/L	0.8	2.8	1.5-7
Platelets	See comments	Clumped, adequate	Moderately decreased	

* Parameters are unavailable due to marked autoagglutination of the sample.

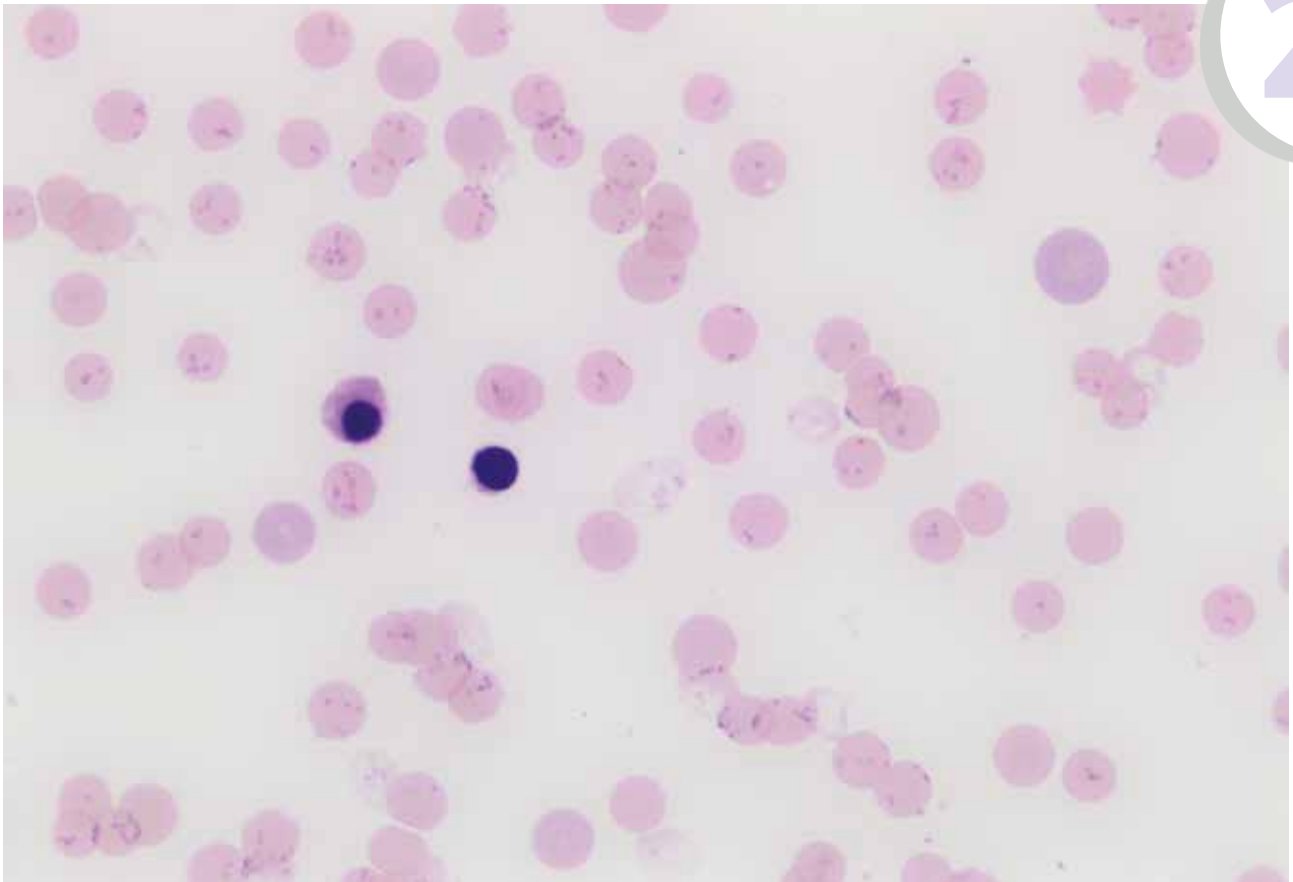
TABLE 2: Biochemistry abnormalities (Case 2 only)

Parameter	Units	Case 2	Reference interval
Bilirubin	µmol/L	173.6	0-3
ALT	IU/L	398	0-88
AST	IU/L	542	0-41

also be increased as an additional indicator of regeneration. The presence of agglutination suggests an immune-mediated component to the haemolytic process, which is frequently present in cases of haemotropic *Mycoplasma* infection. Note that agglutination causes haematology analyser inaccuracies in MCV, MCHC, RBC and HCT. When agglutination is present, PCV and Hgb are likely the most accurate measures of red cell volume.

In Case 1 a lymphopenia is present, consistent with a stress response. In Case 2 there is a left shift, likely due to the infection and immune-mediated inflammation. The thrombocytopenia in Case 2 may be secondary immune-mediated thrombocytopenia.

Biochemistry data is only available for Case 2. Marked hyperbilirubinemia due to haemolysis is present. This was also expected in Case 1, since icterus was visible in the mucous membranes. Increases in hepatocellular leakage enzymes are likely due to effects of hypoxia, and haemolysis is also likely contributing to the AST increase, although concurrent primary hepatic disease is not excluded.



Feline haemotropic *Mycoplasma* (formerly known as *Haemobartonella felis*) include *Mycoplasma haemofelis*, *Candidatus Mycoplasma haemominutum* and *Candidatus Mycoplasma turicensis*, with all three species documented in New Zealand.[1]

M. haemofelis is most frequently associated with clinical disease in immunocompetent cats, producing varying degrees of haemolytic anaemia, although some infected cats may be inapparent carriers with no outward signs of illness.

Polymerase chain reaction (PCR) screening for these organisms should be performed in any feline blood donor due to the potential for clinically unaffected carriers. The roles of *Ca. M. haemominutum* and *Ca. M. turicensis* have yet to be fully elucidated, although mild anaemia may be seen with either, while concurrent disease or immune suppression may increase the susceptibility to clinical anaemia associated with these organisms.[2] Some cats may be infected with multiple haemotropic *Mycoplasma spp.* concurrently.

Diagnosis of infections starts with clinical signs and laboratory data consistent with haemolytic anaemia. Clinical suspicion of feline haemotropic *Mycoplasma* infection should arise if there is evidence of regeneration secondary to haemolysis plus or minus evidence of an immune-mediated component (see the previous answer to the third question). A blood smear should be reviewed in any anaemic animal. In this case, a smear evaluation may make the diagnosis. Small, deeply basophilic inclusions may be seen as cocci, bacilli, or ring-shaped structures associated with the surface of red cells.

Chains or rings of multiple organisms may form, making the haemoparasites appear a bit more distinct. The specificity of a blood smear examination may be quite high in trained hands and can be a rapid and inexpensive in-clinic test. Note that stain precipitate, air drying artifact or other artifactual changes may result in false positives. The sensitivity of blood film cytology is very low compared with PCR for detection of these organisms.[1,3] PCR is more sensitive and specific than a blood smear examination, allowing for the differentiation of species present, and should be performed for the definitive diagnosis of any suspected cases.

Although these infections in cats have typically not been thought to have zoonotic potential, recent case reports involving immunocompromised individuals have suggested the potential for human infection by feline haemotropic *Mycoplasma* species.[4,5]

Additional study using reliable methods such as PCR is warranted to further explore this potential.[6]

In summary, feline haemotropic *Mycoplasma* infection is still a significant disease entity. Clinical features will likely be present that should raise the index of suspicion for the presence of this disease. A blood smear exam is a useful adjunct in the diagnosis of *Mycoplasma*-related anaemia, although PCR is a superior diagnostic. Recent case reports indicate that additional study is warranted to assess the potential for zoonotic risk. VS

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