

**A bad case of anemia**  
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**Signalment**

Mixed breed dog, 9.6 kg, male, neutered, 6.9 years

**History**

- Poor appetite for ~1 month, recent weight loss
- Referring veterinarian identified anemia and neutropenia on blood work
- Prescribed 10 mg of prednisone (~1 mg/kg) twice a day plus sucralfate
- Serologic testing for *Ehrlichia*, heartworm, *Borrelia* and *Anaplasma* was negative
- Recheck at referring veterinarian after one week: Dog had lost 1 pound, was lethargic and drinking frequently
- Referred to the Ontario Veterinary College at the University of Guelph

**Physical Examination**

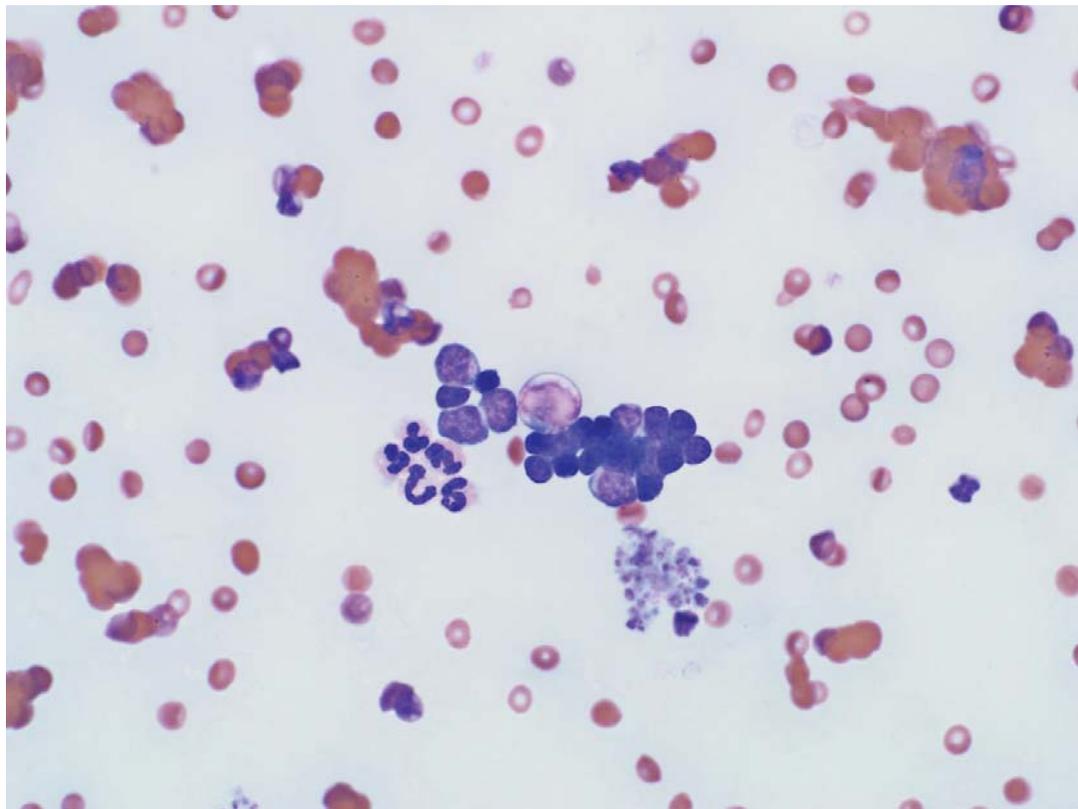
- Weight 8.6 kg, body condition score 3/9
- Very quiet, mucus membranes very pale, grade I/II cardiac murmur
- Otherwise unremarkable

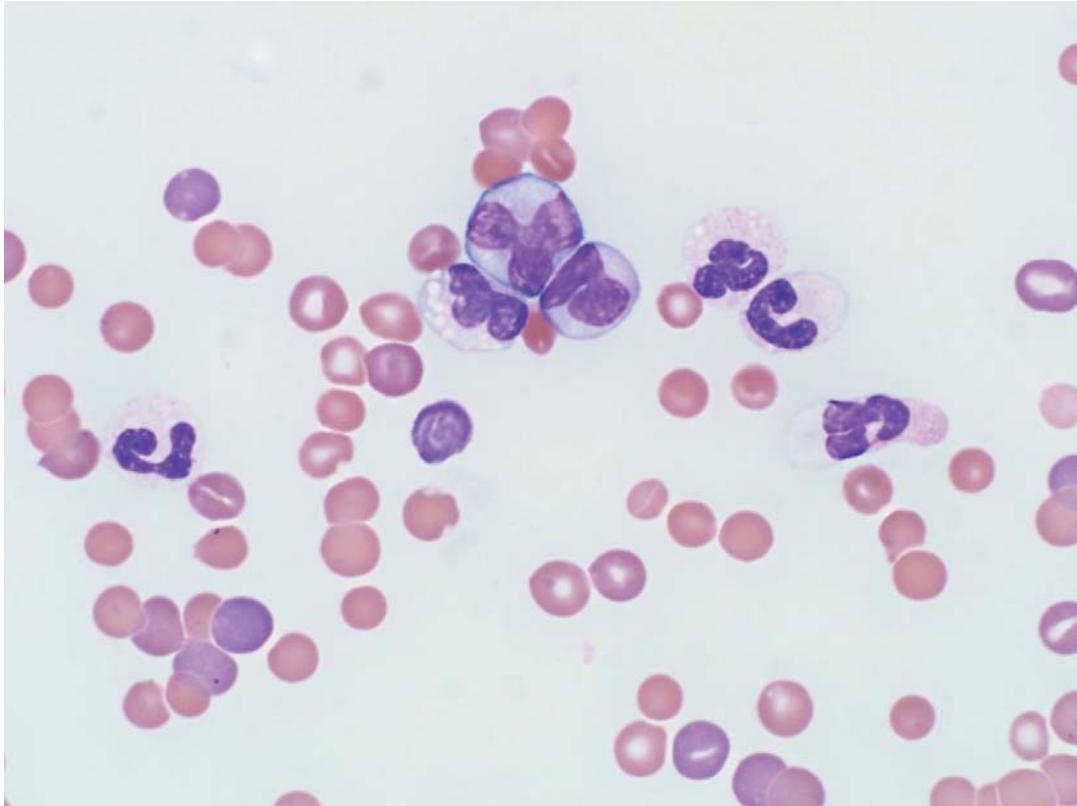
**Laboratory Results – Day 1**

Test	Result		Reference Interval	
WBC	14.1	x 10 <sup>9</sup> /L	4.9-15.4	Reticulocytes 270.7 x10 <sup>9</sup> /L
RBC	0.8 L	x 10 <sup>12</sup> /L	5.8-8.5	Reticulocytes 34.7%
Hb	22 L	g/L	133-197	Direct DAT 1:32
HCT	0.08 L	L/L	0.39-0.56	
MCV	96 H	fL	66-75	<i>Numerous spherocytes</i>
MCH	28 H	pg	21-25	<i>Platelet clumping</i>
MCHC	290 L	g/L	321-360	
RDW	26.6 H	%	11-14	
Platelets	101 L	x 10 <sup>9</sup> /L	117-418	
MPV	22.2 H	fL	7-14	
Plateletcrit	0.23	%	0.14-0.47	
T.S. Protein	81 H	g/L	55-75	
Seg Neutrophil Count	7.19	x 10 <sup>9</sup> /L	2.9-10.6	
Band Neutrophil Count	1.97 H	x 10 <sup>9</sup> /L	0.0-0.3	
Lymphocyte Count	2.96	x 10 <sup>9</sup> /L	0.8-5.1	
Monocyte Count	1.13 H	x 10 <sup>9</sup> /L	0.0-1.1	
Rubricyte Count	0.85 H	x 10 <sup>9</sup> /L	0.0-0.0	
Polychromasia	10-15			

Test	Result		Reference Interval
Hemolysis	Negative		
Lipemia	Negative		
Calcium	2.50	mmol/L	2.50-3.00
Phosphorus	1.19	mmol/L	0.90-1.85
Magnesium	1.0	mmol/L	0.7-1.0
Sodium	151	mmol/L	140-154
Potassium	4.5	mmol/L	3.8-5.4
Chloride	111	mmol/L	104-119
Carbon Dioxide	16	mmol/L	15-25
<b>Anion Gap</b>	<b>28 H</b>	mmol/L	13-24
Na:K Ratio	34		29-37
<b>Total Protein</b>	<b>77 H</b>	g/L	55-74
Albumin	31	g/L	29-43
<b>Globulin</b>	<b>46 H</b>	g/L	21-42
<b>A:G Ratio</b>	<b>0.67 L</b>		0.7-1.8
<b>Urea</b>	<b>15.7 H</b>	mmol/L	3.5-9.0
Creatinine	70	umol/L	20-150
Glucose	6.8	mmol/L	3.3-7.3
<b>Cholesterol</b>	<b>2.54 L</b>	mmol/L	3.60-10.20
<b>Total Bilirubin</b>	<b>8 H</b>	umol/L	0-4
<b>Conjugated Bilirubin</b>	<b>4 H</b>	umol/L	0-1
<b>Free Bilirubin</b>	<b>4 H</b>	umol/L	0-3
Alkaline Phosphatase	98	U/L	22-143
Steroid-induced ALP	31	U/L	0-84
GGT	0	U/L	0-7
ALT	25	U/L	19-107
CK	148	U/L	40-255
Amylase	542	U/L	299-947
Lipase	120	U/L	25-353
Calculated Osmo	312	mmol/L	

Specimen type	Test	Result	
Urine	Colour	Yellow	
	Clarity	Slightly cloudy	
	Volume Submitted	40.0	mL
	Specific Gravity	1.013	
	pH	7.5	
	Multistix Protein	3+	
	Glucose	Negative	
	Ketones	Negative	
	Bilirubin	1+	
	Blood	Trace	
	Urobilinogen	3.2	umol/L
	Leukocytes	None Seen	/400 x
	RBC	Occasional	/400 x
	Epithelial Transitional	Occasional	/400 x
	Fat	1+	





### **Initial Treatment Plan**

Blood transfusion (packed RBC) since increased respiratory rate

Cerenia 1 mg/kg IV

Famotidine 0.5 mg/kg IV

Dexamethasone 0.25 mg/kg IV

Clopidogrel 1/4 tab (75 mg tab) PO

Trazodone 50 mg PRN

Sucralfate 500 mg PO

Cyclosporine 6 mg/kg

### **Other Diagnostic Test Results**

Abdominal ultrasound:

1. Diffuse hyperechoic hepatic parenchyma; likely non-specific, unlikely neoplasia
2. Multiple hypoechoic nodules throughout the spleen, up to 8mm in size; likely lymphoid hyperplasia or extramedullary hematopoiesis

Thoracic radiographs: no abnormalities.

Laboratory Results – Day 4

<b>Test</b>	<b>Result</b>		<b>Reference Interval</b>
<b>WBC</b>	8.4	x 10 <sup>9</sup> /L	4.9-15.4
<b>RBC</b>	<b>1.5 L</b>	x 10 <sup>12</sup> /L	5.8-8.5
<b>Hb</b>	<b>34 L</b>	g/L	133-197
<b>HCT</b>	<b>0.10 L</b>	L/L	0.39-0.56
MCV	69	fL	66-75
MCH	23	pg	21-25
MCHC	338	g/L	321-360
<b>RDW</b>	<b>24.2 H</b>	%	11-14
<b>Platelets</b>	<b>62 L</b>	x 10 <sup>9</sup> /L	117-418
<b>MPV</b>	<b>18.8 H</b>	fL	7-14
<b>Plateletcrit</b>	<b>0.12 L</b>	%	0.14-0.47
T.S. Protein	63	g/L	55-75
Seg Neutrophil Count	4.87	x 10 <sup>9</sup> /L	2.9-10.6
<b>Band Neutrophil Count</b>	<b>0.59 H</b>	x 10 <sup>9</sup> /L	0.0-0.3
Lymphocyte Count	2.27	x 10 <sup>9</sup> /L	0.8-5.1
Monocyte Count	0.17	x 10 <sup>9</sup> /L	0.0-1.1
<b>Rubricyte Count</b>	<b>0.50 H</b>	x 10 <sup>9</sup> /L	0.0-0.0
<b>Polychromasia</b>	<b>5-10</b>		
Reticulocytes	151	x10 <sup>9</sup> /L	5-80
Reticulocytes	11.5%		
<i>Occasional spherocytes</i>			
<i>Mild RBC agglutination</i>			

Test	Result		Reference Interval
Hemolysis	Negative		
Lipemia	Negative		
<b>Calcium</b>	<b>2.22 L</b>	mmol/L	2.50-3.00
<b>Phosphorus</b>	<b>0.79 L</b>	mmol/L	0.90-1.85
Magnesium	0.7	mmol/L	0.7-1.0
<b>Sodium</b>	<b>139 L</b>	mmol/L	140-154
Potassium	5.0	mmol/L	3.8-5.4
Chloride	107	mmol/L	104-119
Carbon Dioxide	16	mmol/L	15-25
Anion Gap	21	mmol/L	13-24
<b>Na:K Ratio</b>	<b>28 L</b>		29-37
Total Protein	62	g/L	55-74
<b>Albumin</b>	<b>26 L</b>	g/L	29-43
Globulin	36	g/L	21-42
A:G Ratio	0.72		0.7-1.8
Urea	4.9	mmol/L	3.5-9.0
Creatinine	52	umol/L	20-150
Glucose	6.2	mmol/L	3.3-7.3
<b>Cholesterol</b>	<b>1.84 L</b>	mmol/L	3.60-10.20
<b>Total Bilirubin</b>	<b>7 H</b>	umol/L	0-4
<b>Conjugated Bilirubin</b>	<b>3 H</b>	umol/L	0-1
<b>Free Bilirubin</b>	<b>4 H</b>	umol/L	0-3
Alkaline Phosphatase	98	U/L	22-143
Steroid-induced ALP	43	U/L	0-84
GGT	1	U/L	0-7
ALT	31	U/L	19-107
CK	113	U/L	40-255
Amylase	377	U/L	299-947
Lipase	117	U/L	25-353
Calculated Osmo	279	mmol/L	

“Micah” was discharged on day 5 with a diagnosis of primary immune-mediated hemolytic anemia (IMHA) and the following medications:

Prednisone 20 mg (~2 mg/kg) once per day

Clopidogrel 20 mg (~2 mg/kg) once per day

Cerenia 16 mg – give as needed to control nausea or inappetence

Sucralfate 2 mL of 200 mg/mL oral suspension every 8 hrs

### **Follow-up**

- CBC performed by referring veterinarian on day 8 was essentially unchanged from discharge
- On **day 22** Micah started to become lethargic, drinking more, panting frequently and consistently sleeping
- She was taken to her family veterinarian who noted weight gain and discharged Micah with RC recovery food to continue her weight gain
- On **day 23** Micah was unable to stand and taken to the local emergency clinic
- In-clinic CBC: hematocrit 3.5 L/L, platelets  $65 \times 10^9/L$  and reticulocytes  $182 \times 10^9/L$
- Referred back to OVC

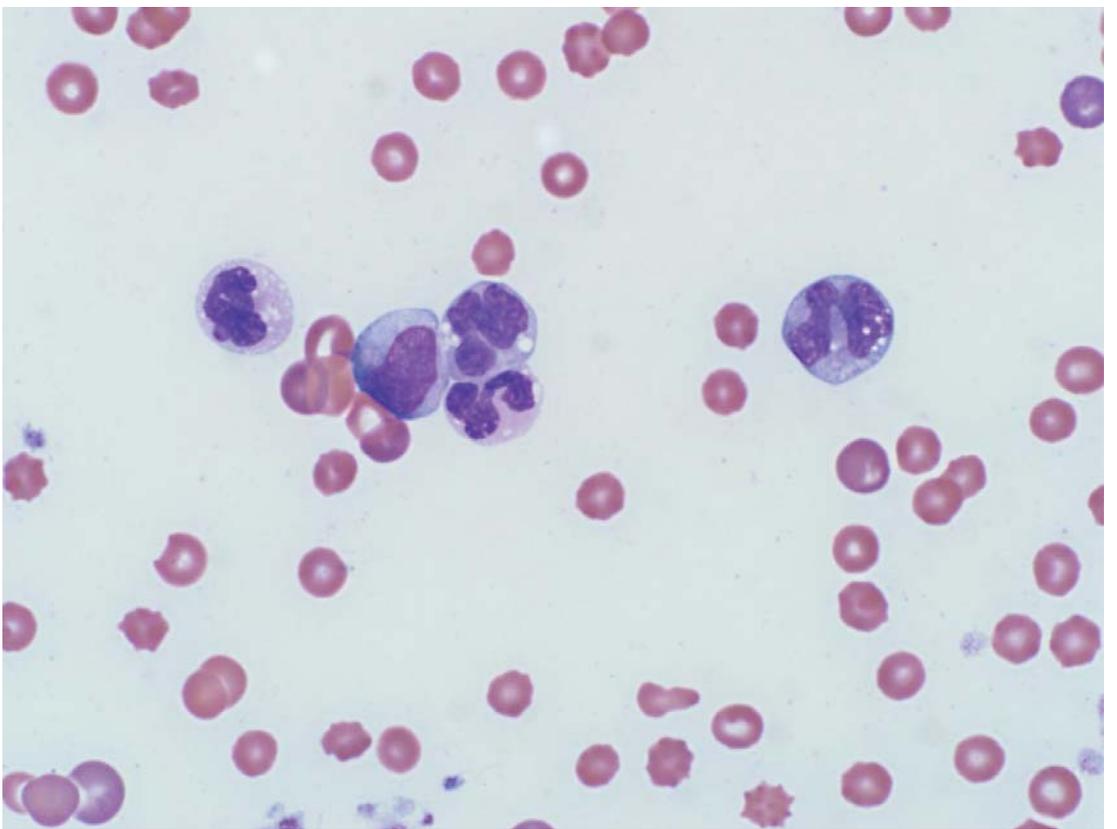
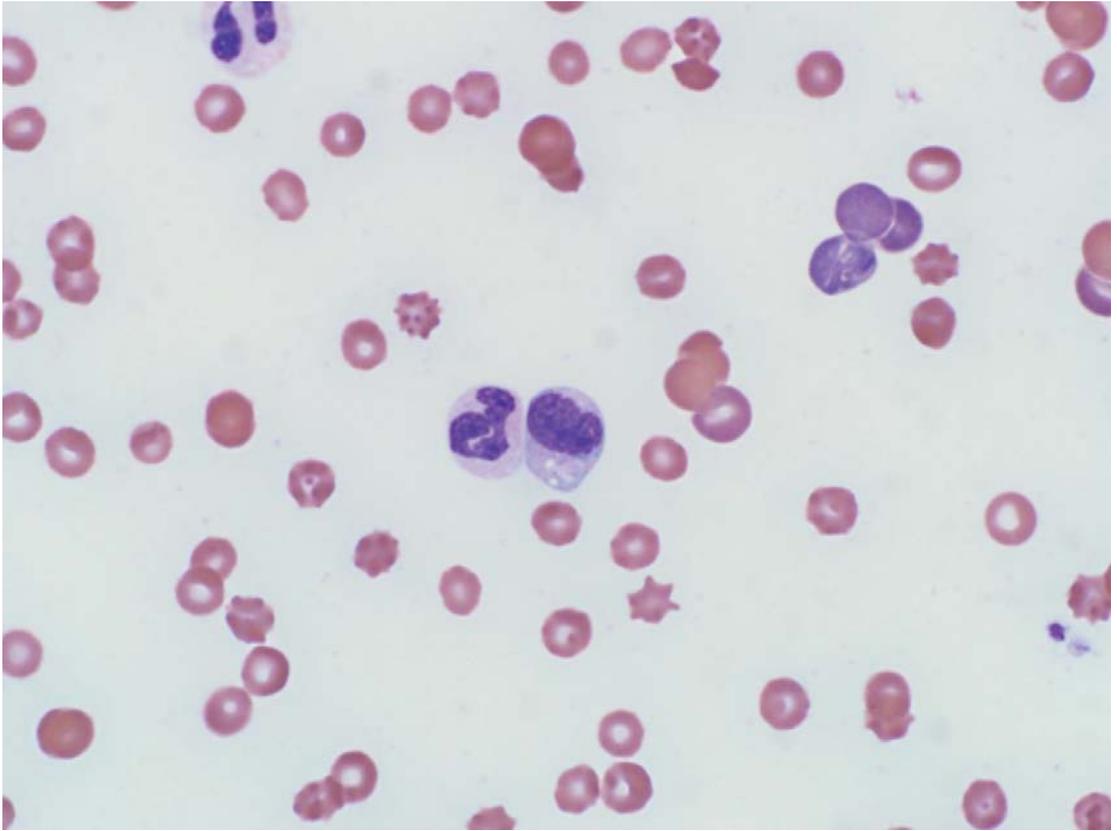
### **Re-assessment – Day 23**

- Mucus membranes were white/jaundiced, HR 200, RR 36
- Auscultation and palpation: no abnormal findings
- Weight 6.9 kg, body condition score 2/9, lactate 18 mmol/L
- Treated with 0.25 mL/kg dose of iv dextrose and packed RBC transfusion

### **Laboratory Results – Day 26**

- Leptospira microscopic agglutination test: negative for *L. icterohemorrhagica*, *L. hardjo*, *L. grippityphosa*, *L. pomona*, *L. canicola*; low titer for *L. autumnalis*
- Liver aspirate: Mild hepatocellular vacuolar change and trilineage hematopoiesis

Test	Result		Reference Interval
WBC	5.9	x 10 <sup>9</sup> /L	4.9-15.4
RBC	1.2 L	x 10 <sup>12</sup> /L	5.8-8.5
Hb	27 L	g/L	133-197
HCT	0.08 L	L/L	0.39-0.56
MCV	73	fL	66-75
MCH	24	pg	21-25
MCHC	321	g/L	321-360
RDW	21.9 H	%	11-14
Platelets	58 L	x 10 <sup>9</sup> /L	117-418
MPV	21.8 H	fL	7-14
Plateletcrit	0.13 L	%	0.14-0.47
T.S. Protein	66	g/L	55-75
Seg Neutrophil Count	4.54	x 10 <sup>9</sup> /L	2.9-10.6
Band Neutrophil Count	0.41 H	x 10 <sup>9</sup> /L	0.0-0.3
Lymphocyte Count	0.41 L	x 10 <sup>9</sup> /L	0.8-5.1
Monocyte Count	0.24	x 10 <sup>9</sup> /L	0.0-1.1
Immature Count	0.06 H	x 10 <sup>9</sup> /L	0.0-0.0
Rubricyte Count	0.24 H	x 10 <sup>9</sup> /L	0.0-0.0
Polychromasia	2-5		
Anisocytosis	2+		
Reticulocytes	106	x10 <sup>9</sup> /L	5-80
Reticulocytes	9.2%		
<i>Rare spherocytes</i>			
<i>Mild RBC agglutination</i>			
<i>Occasional metamyelocytes</i>			
Hemolysis	Mild		
Lipemia	Negative		
Total Protein	62	g/L	55-74
Albumin	25 L	g/L	29-43
Globulin	37	g/L	21-42
A:G Ratio	0.68 L		0.7-1.8
Urea	8.6	mmol/L	3.5-9.0
Glucose	6.0	mmol/L	3.3-7.3
Cholesterol	3.43 L	mmol/L	3.60-10.20
Total Bilirubin	8 H	umol/L	0-4
Alkaline Phosphatase	107	U/L	22-143
Steroid-induced ALP	43	U/L	0-84
GGT	0	U/L	0-7
ALT	1484 H	U/L	19-107
Bile Acid	21 H	umol/L	0-6



## **Other Tests – Day 27**

### **Sternal bone marrow aspirate** (no sedation):

“The sample is hemodiluted and poorly cellular with no particles. Individual rubricytes, granulocytic precursors and megakaryocytes were observed but neither cell maturation nor distribution can be assessed. The sample may not be representative of the hematopoietic tissue.”

### **Questions:**

1. What are the differential diagnoses in this dog?
2. Have the differential diagnoses changed since the first episode of anemia?
3. What additional diagnostic steps should be performed?
4. What is the prognosis for this dog at this point?