

## EXERCISE 15 – PATHOLOGY AND QUESTIONS

### Differential diagnoses for red water (haemoglobinuria and/ or haematuria) in cattle in New Zealand

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#### Case 1

#### History and clinical findings:

Two 14 month old Friesian calves showed non specific signs of illness and produced red urine for one day. Samples were taken for routine biochemistry, haematology and urinalysis.

#### Results:

**Table 1: Haematological and biochemical results**

	Results: calf 19	Results: calf 21	Reference range	Units
<b>RBC</b>	8.88	9.19	5.0-7.7	$\times 10^{12}/l$
<b>Haemoglobin</b>	106	111	80-140	g/l
<b>HCT/PCV</b>	0.28	0.30	0.24-0.40	l/l
<b>MCV</b>	32	33	40-58	fl
<b>MCH</b>	12	12		
<b>MCHC</b>	376	370	260-360	g/l
<b>WBC</b>	11.3	11.4	4.0-12.0	$\times 10^9/l$
<b>Neutrophils</b>	6.78	6.84	0.60-4.50	$\times 10^9/l$
<b>Lymphocytes</b>	3.73	3.99	1.80-7.50	$\times 10^9/l$
<b>Monocytes</b>	0.68	0.57	0.10-0.70	$\times 10^9/l$
<b>Eosinophils</b>	0.11	0	0-2.0	$\times 10^9/l$
<b>Sodium</b>	137	134	132-154	mmol/l
<b>Potassium</b>	6.1	4.7	3.9-5.8	mmol/l
<b>Na/K ratio</b>	22.5	28.5	Ratio	
<b>Chloride</b>	98	93		mmol/l
<b>Bicarbonate</b>	26	26	26-34	mmol/l
<b>Anion gap</b>	19.1	19.7	12-22	mmol/l
<b>Creatinine</b>	Haemolysed	Haemolysed	80-249	umol/l
<b>Urea</b>	5.0	5.1	4.5-10.0	mmol/l
<b>Phosphate</b>	2.60	2.32	1.41-2.95	mmol/l
<b>Calcium</b>	2.47	2.50	2.12-2.62	mmol/l
<b>Magnesium</b>	0.99	1.00	0.60-1.23	mmol/l
<b>Bilirubin</b>	4	8	0-15	umol/l
<b>GGT</b>	Haemolysed	Haemolysed	9-39	U/l
<b>GLDH</b>	730	269	8-41	U/l
<b>B-OHB</b>	0.1	0.4	0.2-1.0	mmol/l
<b>AST</b>	743	267	68-214	U/l
<b>CK</b>	734	456	105-1487	U/l
<b>Total Protein</b>	51	51	63.4-91.8	g/l
<b>Albumin</b>	33	32	27.8-45.3	g/l
<b>Globulin</b>	18	19	30.6-57.9	g/l
<b>A/G Ratio</b>	1.83	1.68	0.52-1.22	Ratio

**Smear comments for haematology:** RBCs and platelets were normal

**Comments for serum biochemistry:** Both sera samples were received grossly haemolysed so treat results with caution.

**Table 2: Urinalysis**

	<b>Calf: 19</b>	<b>Calf: 21</b>
<b>Colour</b>	Red	Red
<b>Turbidity</b>	Clear	Clear
<b>pH</b>	6.5	7.5
<b>Blood</b>	4+	4+
<b>Protein</b>	1+	1+
<b>Glucose</b>	Negative	Negative
<b>Ketones</b>	Negative	Negative
<b>Bilirubin</b>	Negative	Negative
<b>Specific gravity</b>	1.003	1.002

**Sediment comments calf 19**

1WBC/hpf  
Occasional squamous epithelial cell seen  
Occasional bacteria seen  
Small amounts of amorphous debris/hpf

**Sediment comments calf 21:**

3 WBCs/hpf  
Occasional squamous epithelial cell seen  
Occasional bacteria seen  
Small amounts of amorphous debris/hpf

**Case 2**

**History and clinical findings:**

A six year old cow of mixed breed was found recumbent, hypothermic and showed extreme icterus of the mucus membranes. A urine sample was obtained but was heavily contaminated with a purulent uterine discharge. She was grazing pasture, with no additional supplements.

**Results:**

**Table 3: Haematological and biochemical results**

	<b>Results</b>	<b>Reference range</b>	<b>Units</b>
<b>RBC</b>	1.73	5.0-7.7	$\times 10^{12}/l$
<b>Haemoglobin</b>	35	80-140	g/l
<b>HCT/PCV</b>	0.10	0.24-0.40	l/l
<b>MCV</b>	59	40-58	fl
<b>MCH</b>	20		
<b>MCHC</b>	345	260-360	g/l
<b>NRBC</b>	6.0		/100 WBCs
<b>WBC</b>	37.0	4.0-12.0	$\times 10^9/l$

<b>Neutrophils</b>	30.34	0.60-4.50	$\times 10^9/l$
<b>Band neutrophils</b>	4.07	0.00-0.10	$\times 10^9/l$
<b>Lymphocytes</b>	3.73	1.80-7.50	$\times 10^9/l$
<b>Monocytes</b>	0.68	0.10-0.70	$\times 10^9/l$
<b>Eosinophils</b>	0.11	0-2.0	$\times 10^9/l$
<b>Absolute reticulocyte count</b>	27.88		$\times 10^9/l$
<b>Plasma protein</b>	76.0		
<b>Fibrinogen</b>	4		
<b>Sodium</b>	140	132-154	mmol/l
<b>Potassium</b>	3.1	3.9-5.8	mmol/l
<b>Na/K ratio</b>	45.2	Ratio	
<b>Chloride</b>	23		mmol/l
<b>Bicarbonate</b>	26	26-34	mmol/l
<b>Anion gap</b>	29.1	12-22	mmol/l
<b>Creatinine</b>	56	80-249	umol/l
<b>Urea</b>	18.8	4.5-10.0	mmol/l
<b>Phosphate</b>	1.18	1.41-2.95	mmol/l
<b>Calcium</b>	3.71	2.12-2.62	mmol/l
<b>Magnesium</b>	2.02	0.60-1.23	mmol/l
<b>Bilirubin</b>	79	0-15	umol/l
<b>GGT</b>	146	9-39	U/l
<b>GLDH</b>	1180	8-41	U/l
<b>B-OHB</b>	0.5	0.2-1.0	mmol/l
<b>AST</b>	2185	68-214	U/l
<b>CK</b>	3195	105-1487	U/l
<b>Total Protein</b>	73	63.4-91.8	g/l
<b>Albumin</b>	31	27.8-45.3	g/l
<b>Globulin</b>	42	30.6-57.9	g/l
<b>A/G Ratio</b>	0.74	0.52-1.22	Ratio

**Smear comments for haematology:** RBCs show moderate anisocytosis with moderate numbers of polychromatic cells and basophilic stippling, occasional macrocytes and microcytes present. Platelets appear normal and increased in number.

**Comments for serum biochemistry:** Serum sample was received brown in colour so treat results with caution.

**Table 2: Urinalysis**

	<b>Cow</b>
<b>Colour</b>	Red - brown
<b>Turbidity</b>	Cloudy
<b>pH</b>	7.5
<b>Blood</b>	4+
<b>Protein</b>	4+
<b>Glucose</b>	Negative
<b>Ketones</b>	Negative
<b>Bilirubin</b>	Negative
<b>Specific gravity</b>	1.030

**Sediment comments Cow:**

500+ WBCs.

1 squamous epithelial cell/hpf

Occasional triple phosphate crystals seen

Large numbers of bacteria present.

Occasional granular cast.

**Questions to consider when reading the clinical pathology results**

1. Is anaemia present?
2. Is there an inflammatory leucogram?
3. What is the urine SG?
4. What is the urinary sediment like?
5. What is significant in the biochem?
6. What further tests would be useful?
7. What is the possible differential list?
8. What further questions would you ask the practitioner, and what further information would be useful from the owner to help to narrow down your list?
9. What follow up samples would you like to see and why?

**General differential diagnoses for “red urine” to consider in both of the cases (for New Zealand conditions)****Haemoglobinuria**

- Causes are those of haemolysis and RBC destruction
- Heinz bodies with causes such as ingestion of brassicas , kale, onions
- *Leptospira pomona* infection
- Bacillary haemoglobinuria
- Hypotonic haemolysis
- Sporidesmin toxicity following growth of *Pithomyces chartarum* in the pasture (facial eczema), this causes haemolysis by unknown mechanism
- Chronic copper toxicity
- Postparturient haemoglobinuria

**Haematuria**

- Cystitis and/ or nephritis
- Bracken fern toxicity
- Sporidesmin toxicity (facial eczema), this causes a haemorrhagic cystitis
- Neoplasia