Tortoise Clinical Pathology

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What is a “Tortoise”? 

- Many species now available!
Testudo

- Spur-Thighed Tortoise
- Hermanns tortoise
- Marginated tortoise
- Horsfields tortoise
The Problems

- We can’t see inside
- We can’t feel inside
- Clinical pathology seems a good idea to get some answers
- Do we know what questions to ask?
- Does it tell us the truth?
What we will cover...

- Not a complete coverage
- Reviewing some of the difficulties with interpretation
- Discussion please!
The Problems

- Seasonality
- Sex
- Age
- Lymphodilution
- Changes in the post
Changes in the post...

- **Raised**
  - Potassium
  - Phosphate
- **Lowered**
  - Sodium?
  - Ionised Ca?
So, to minimise problems...

- Air-dried smear
- Use of patient-side machines?
- Send spun sample too?
Seasonality

- **Rise in Winter**
  - TWBC
  - Eosinophils

- **Rise in summer**
  - Hets
  - Lymphocytes
  - Cholesterol (females)
  - Glucose
  - Potassium
PCV

- Rise in hibernation
- Lowest in middle winter & summer
Post-hibernation

- **Low**
  - TWBC
  - Hets
  - Eosinophils??
  - Glucose!
  - Na/K..rising

- **High**
  - PCV
  - Lymphocytes?
<table>
<thead>
<tr>
<th>Sex</th>
<th>Male</th>
<th>Female</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>PCV</td>
<td>Lymphocytes</td>
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<tr>
<td></td>
<td></td>
<td>Albumin</td>
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<tr>
<td></td>
<td></td>
<td>Cholesterol (summer)</td>
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<td></td>
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<td>Triglyceride</td>
</tr>
</tbody>
</table>
Reproduction

- Breeding females have raised
  - TP
  - Albumin
  - ALKP
  - Total Ca
  - Ionised Ca
  - Phosphate
  - Triglyceride
• Prolonged reproductive picture outside of “normal breeding season”
• Repeated findings of non-progressive follicles
  - Endoscopy
  - Ultrasonography
A FUNCTIONING FEMALE REPRODUCTIVE SYSTEM IS NOT NECESSARILY A DISEASE
Age

- Immatures have lower
  - PCV
  - Albumin
- Immatures have higher
  - Lymphocytes
  - Phosphate
Lymphodilution

- **Lowers**
  - PCV
  - TWBC
  - Lymphocytes
  - Albumin
  - Globulin
  - TP
  - Total Ca
  - Uric acid
Effect of site??

- Sinuses?
- Tail vein/ sub-carapacial?
- Is the jugular the gold standard?
- What we need
  - Be honest!!
  - Tell pathologist
  - Send air-dried slide
How do we assess dehydration?

- Is it urinating?
- Can we use urine SG?
- Bloods
  - Protein/ HCT??
  - Urea?
  - Uric acid?
Osmolarity?

- \(2(\text{Na}^+ + \text{K}^+) + \text{glucose} + \text{urea} = \text{osmolarity}\)
- 258 to 467 mOsm/l
- Seasonal effects?
- Quality of hibernation?
- Effects on fluid therapy?
How do we distinguish renal disease from dehydration?

- Uric acid?
- Urea?
- Creatinine?
- Ca:P???
- Potassium?
Value of repeated samples?

Why does uric acid rise after fluids?
Prognostic Indicators!

- Urea
- Uric acid
- Potassium
How do we assess liver function/disease??

- Always bloods?
- Enzymes
  - ALKP
  - ALT
  - AST
  - GGT
  - GLDH
  - LDH
- Proteins
- Cholesterol?
Bile acids?

- Useful?
- Species differences?
- Seasonal differences?
- Effects of feeding?
- Association with pathology?
- If persistently very high??
PHA?

- Assess hydration
- Assess blood cells
  - Responses
  - Infection?
  - Immunosuppression?
  - Significance of blood parasites?
- Assess prognosis
- Evidence of renal disease?
- Evidence of depletion??
Depletion

- Reduction of body stores such that there is nothing left to metabolise!
- Glucose
- Beta- HB??
Typical UK PHA sample...

- **Lowered**
  - Haematology
  - Sodium
  - Glucose

- **Raised**
  - Tissue enzymes
  - Urea
  - (Uric acid)
  - (Potassium)
  - (Beta-HB)
Still haematology is simple?

- Numbers?
- Seasonal variation?
- Morphology?
- Stem cells?
Electrophoresis

- Interpretation?
- More sensitive?
- Predictive?
- Normal values?
- Effects of sample quality?
Parasitology

- What is a parasite?
- How significant are findings?
- Commensals?
Blood parasites

- In the UK!
- No vectors
- Age of tortoise relevant
- Disease significance?
- In Spain?
So, how about pathogen checks?

- PCR’s?
- ChHV?
- Mycoplasma?
- Is swabbing effective?
- Significance if found?
- Significance if not found??
- How do you change therapy if confirmed?
Role of culture?

- How well do we understand commensals and normal flora?
- Faecal culture?
- Oral / lung cultures?
- Anaerobes?
- Combine with cytology?
What do we need?

- More knowledge!
- Normals
  - Species
  - Husbandry
  - Seasonality
  - Gender
  - Diet
- Common sense!