Case # 60
Peripheral blood smear from a dog

Sayuri Hayakawa
Elizabeth G. Welles, Stephanie M. Shrader,
Jey W. Koehler, Lenore M. Bacek

1 Department of Pathobiology, 2 Department of Clinical Sciences
Auburn University College of Veterinary Medicine

Permission granted only for viewing on SEVPAC website
Signalment and history

- 13-year-old, M/N, Boxer
- 1-2 week history of anemia (initial Hct 27%); no response to corticosteroids (Hct 18%)
- Intermittent epistaxis
- Possible splenic mass
- Physical exam:
  - T100.9 F, pulse 128 bpm, respiratory rate 16 brpm
  - Pale mucous membranes
  - BCS 3/9
  - Heart and lungs auscultated normally
<table>
<thead>
<tr>
<th>CBC</th>
<th>Patient’s values</th>
<th>Reference interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hct (%)</td>
<td>15.0 ↓</td>
<td>38.7 – 59.2</td>
</tr>
<tr>
<td>MCV (fL)</td>
<td>70.2</td>
<td>60.5 – 73.8</td>
</tr>
<tr>
<td>MCHC (g/dL)</td>
<td>30.8 ↓</td>
<td>32 – 37.2</td>
</tr>
<tr>
<td>Reticulocytes (/μL)</td>
<td>185,100 ↑</td>
<td>0 – 60,000</td>
</tr>
<tr>
<td>Platelets (/uL)</td>
<td>48,000 ↓</td>
<td>152,000 – 510,000</td>
</tr>
<tr>
<td>MPV (fL)</td>
<td>23.2 ↑</td>
<td>8 – 14.6</td>
</tr>
<tr>
<td>WBC (/μL)</td>
<td>32,460 ↑</td>
<td>5,090 – 17,410</td>
</tr>
<tr>
<td>Neutrophils (/μL)</td>
<td>26,617 ↑</td>
<td>2,600 – 10,400</td>
</tr>
<tr>
<td>Bands (/μL)</td>
<td>649 ↑</td>
<td>0 – 300</td>
</tr>
<tr>
<td>Lymphocytes (/μL)</td>
<td>1,298</td>
<td>390 – 6,730</td>
</tr>
<tr>
<td>Monocytes (/μL)</td>
<td>3,895 ↑</td>
<td>160 - 1,160</td>
</tr>
</tbody>
</table>
Blood smear 200x
Blood smear 600x

Permission granted only for viewing on SEVPAC website
Blood smear 1000x

Schistocyte  
Keratocyte  
Acanthocyte
• Imaging findings:
  - Free fluid in peritoneal cavity
  - Diffusely mottled appearance in liver and spleen
  - Mass in the right cranial lung field

• Cytologic findings:
  - Hemorrhagic effusion in peritoneal cavity (Hct 12.2%)
  - Marked extramedullary hematopoiesis in liver and spleen

• Following the diagnostic tests:
  - Euthanized due to grave prognosis
Gross necropsy findings

~1L of blood and blood clots in peritoneal cavity
Spleen: Multifocal to coalescing, raised, soft, hemorrhagic nodules

Liver: Multifocal to coalescing, variably hemorrhagic cavitations and nodules
Lungs: 4.5 cm diameter, irregularly shaped, firm, white depressed area in the right cranial lung lobe
• Based on all the findings, hemangiosarcoma was the top differential

• Histopathologic findings:
  - Neoplasia was not found in the liver and spleen
    - Liver: Interstitial and portal fibrosis, extramedullary hematopoiesis, peliosis hepatis, hemorrhage, and fibrin thrombi
    - Spleen: Telangiectasis, hemorrhage, multifocal fibrin deposition, extramedullary hematopoiesis
- Pulmonary papillary adenocarcinoma
- Rafts of neoplastic cells in small-caliber vessels of lungs
- Fibrin thrombi in small-caliber vessels of lungs and liver
• Morphologic diagnosis and interpretation:

- Pulmonary adenocarcinoma with secondary microangiopathic hemolytic anemia and likely disseminated intravascular coagulation (DIC)
Microangiopathic hemolytic anemia

- Fragmentation anemia
  - RBCs are forced to traverse altered vascular channels
- Schistocytes, keratocytes, acanthocytes
- Causes:
  - Neoplasia, DIC, vasculitis, thrombosis, endocarditis, glomerulonephropathy, caval syndrome of dirofilariasis, hemolytic uremic syndrome
- In this dog, pulmonary adenocarcinoma and DIC are most likely the cause for microangiopathy
  - Neoplastic cells exhibited vascular invasion
  - 100% of blood traverses pulmonary vasculature
  - May have directly caused trauma to RBCs
EM of schistocyte, tumor cell, fibrin

DIC

• In dogs, hemangiosarcoma is the most common neoplasia associated with DIC

• Other tumors include:
  - Primary lung tumors, inflammatory mammary gland tumors, thyroid carcinomas, intra-abdominal carcinomas

• Mechanisms of cancer-induced hypercoagulable state
  - Not always understood
  - In people, predisposition for developing DIC
    - Tissue factor and activators of factor X expressed by cancer cells
    - Tissue factor may also be expressed by circulating monocytes in response to tumor antigens
Case Summary

• Microangiopathic hemolytic anemia and DIC
  – Pulmonary adenocarcinoma in this case
  – Hemangiosarcoma is the most common cause
  – Remember to also consider other neoplasia with these findings

• Antemortem findings of abnormal RBC morphology
  – Microangiopathic disorder
  – May guide investigation of potential causes during necropsy
References


Acknowledgements

• Clin Path Lab technicians

Questions?