Primary lymph node neoplasia = Lymphoma

Covered in primary hematopoietic neoplasia*
Lymph node metastasis:

- Common with carcinomas, melanomas, mast cell tumors...
- May see lymph node enlargement
- Variable effacement of normal architecture

One basis of staging tumor malignancy

- Stage 0: regional node normal
- Stage 1: regional node enlarged but still freely moveable
- Stage 2: regional node enlarged and fixed
Metastasis of mammary carcinoma to a lymph node

Images: Courtesy of Dr Hanna, AVC
Thymus – Structure and function

- White to pink, lobulated organ within the anterior mediastinum
- Ruminants and pigs have a large cervical lobe that extends along the cervical trachea
Thymus – Structure and function

• Structure
  – Composed of epithelial tissue and lymphoid tissue
  – Lobulated and split into cortical and medullary areas

• Function
  – Proliferation & maturation of T cells
Thymus – Miscellaneous diseases

**Miscellaneous diseases**

- Lymphocytolysis/thymic atrophy
- Thymic aplasia/hypoplasia
- Thymic hemorrhage/hematoma

- Can lead to acquired immunodeficiency
- Congenital immunodeficiency

Cornell Veterinary Medicine
General Features:
• Space occupying mass in cranial mediastinum
• Dyspnea
• 2 main differentials
Thymic Lymphoma
Neoplastic proliferation of T-lymphocytes
Often younger animals (cats, calves, and dogs)
Malignant behaviour

Thymoma
Neoplastic proliferation of Epithelial cells
Less common – dogs, sheep, goats
Slow growing, encapsulated
• Present in the left cranial part of the abdomen within the greater omentum
• Attached to the greater curvature of the stomach
• Covered by a fibromuscular capsule and dissected by fibromuscular trabeculae
• Varies in size and shape among species

Normal spleen from a cat
<table>
<thead>
<tr>
<th>Structure</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Red Pulp</strong></td>
<td><strong>Function</strong></td>
</tr>
<tr>
<td>• Sinusoids/vascular spaces</td>
<td>• Filters blood - removal of foreign material (phagocytosis)</td>
</tr>
<tr>
<td>• Splenic cords</td>
<td>• RBC storage</td>
</tr>
<tr>
<td></td>
<td>• Hematopoiesis (EMH)</td>
</tr>
<tr>
<td><strong>White Pulp</strong></td>
<td><strong>Immune response</strong></td>
</tr>
<tr>
<td>• Periarterial lymphatic sheaths (PALS) (T-cells)</td>
<td>•</td>
</tr>
<tr>
<td>• Lymphoid nodules (B-cells)</td>
<td></td>
</tr>
<tr>
<td>• Marginal zone (Macrophages)</td>
<td></td>
</tr>
</tbody>
</table>
Diseases of the spleen

- Miscellaneous Diseases
- Circulatory diseases of the spleen
- Inflammation of the spleen (splenitis)
- Adaptations of growth
  - Aplasia/Hypoplasia, Hyperplasia, Atrophy
- Primary and secondary splenic neoplasia
Splen – Miscellaneous diseases

Misc. Diseases

- Siderofibrosis (Gamnagandy bodies)
- Splenic Amyloidosis
- Splenic Contraction
- Splenic Rupture
- Splenic Torsion
Spleen – Miscellaneous diseases

Siderofibrosis = Gamna-Gandy bodies

- Incidental finding/ senile change
- Possible sequela of prior hemorrhage

Gross: Granular white-yellow deposits in the splenic capsule
Spleen – Miscellaneous diseases

Siderofibrosis = Gamna-Gandy bodies

- Incidental finding/senile change
- Possible sequela of prior hemorrhage

Histo: Hematoidin, hemosiderin and mineral deposits
Splenic amyloidosis

- Usually 2° amyloidosis - chronic inflammation
- Gross: Splenomegaly, beige to orange discolouration
### Splenic contraction

- Contraction of the smooth muscle in the capsule/trabeculae
- Occurs with catecholamine release, shock, acute splenic rupture
- Gross: Small dry spleen with wrinkling of the capsule

![Normal spleen](Image1)

![Splenic contraction](Image2)
Spleen – Miscellaneous diseases

Splenic contraction

- Contraction of the smooth muscle in the capsule/trabeculae
- Occurs with catecholamine release, shock, acute splenic rupture
- Gross: Small dry spleen with wrinkling of the capsule

Contraction can be incomplete: Grossly, looks very similar to splenic infarction
Spleen – Miscellaneous diseases

**Splenic contraction**

- Contraction of the smooth muscle in the capsule/trabeculae
- Occurs with catecholamine release, shock, acute splenic rupture
- Gross: Small dry spleen with wrinkling of the capsule

Compare to splenic infarction

Contraction can be incomplete: Grossly, looks very similar to splenic infarction
Splenic rupture

- Fairly common
- Primary - trauma
- Secondary to splenomegaly, splenic neoplasia
- Potential sequelae include hemoabdomen and splenosis

Splenic rupture 2° to hemangiosarcoma in a dog

Splenic rupture and hemoabdomen 2° to splenomegaly (lymphoma) in a pig
Splenic rupture → splenosis

- Seeding of splenic explants on peritoneal surfaces forming accessory spleens

**Gross:** Small red nodules within the omentum

Can be mistaken for hemangiosarcoma metastases

Image: Cornell Veterinary Medicine
Spleen – Miscellaneous diseases

**Splenic rupture → splenosis**

- Seeding of splenic explants on peritoneal surfaces forming accessory spleens

**Gross:** Small red nodules within the omentum

**Histology:** Look like small (normal) spleens

Image: Cornell Veterinary Medicine
Splenic torsion

- Dogs and pigs
- With or without the stomach (GDV*)
- Twists around the gastrosplenic ligament

Gross: Splenomegaly, blue to black, folded back on itself
## Spleen – Circulatory disturbances

<table>
<thead>
<tr>
<th>Circulatory disturbances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active hyperemia</td>
</tr>
<tr>
<td>Passive congestion</td>
</tr>
<tr>
<td>Splenic infarction</td>
</tr>
<tr>
<td>Splenic hematoma</td>
</tr>
</tbody>
</table>
Spleen – Circulatory disturbances

**Active hyperemia**
- Acute systemic infection

**Passive congestion**
- Vascular pooling (shock)
- Barbiturate administration**
- Hemolytic anemia

Similar grossly:
- Splenomegaly
- Red to purple
- Oozes blood on cut surface
Spleen – Circulatory disturbances

Active hyperemia
• Acute systemic infection

Passive congestion
• Vascular pooling (shock)
• Barbiturate administration**
• Hemolytic anemia

Similar grossly:
• Splenomegaly
• Red to purple
• Oozes blood on cut surface
Splenic congestion from barbiturate euthanasia in a horse – marked splenomegaly

**Histology:** Red pulp dilated and contains blood; the white pulp is widely separated

Dr MD McGavin, College of Veterinary Medicine, University of Tennessee
**Spleen – Circulatory disturbances**

**Splenic Infarcts:**

Ischemic necrosis of the spleen

1. Vascular damage
2. Hypercoagulable states
3. Splenomegaly (of any cause)
4. Septic emboli

Due to thrombosis

**Gross Lesions:**

Acutely: infarcts are discrete, raised, and dark red – at the margins of the organ

With time: pale and firm (fibrosis)
Splenic hematoma

- Common in dogs
- Trauma
- Often associated with nodular hyperplasia or vascular tumours

**Gross:** Red nodular mass. Often very large, soft and dark red on cut surface

*Need histology to rule out underlying neoplasia!*
## Spleen – Inflammation

### Acute splenitis – Multifocal necrosisuppurative splenitis

- Tularemia (*Francisella tularensis*)
- Yersiniosis (*Yersinia pseudotuberculosis*)

**Gross:** Multifocal miliary white foci within the spleen.
- Can see similar lesions in the lymph nodes and liver
- Older lesions resemble granulomas/abscesses

*Images courtesy of Dr Daoust*
Acute splenitis – Septicemic splenitis

- African swine fever
- Erysipelas
- Anthrax**

Gross Findings
- Splenomegaly
- Dark discoloration
- Engorged with viscous blood

Spleen from a pig
Acute splenitis – Septicemic splenitis - ANTHRAX

- A disease caused by a spore forming bacterium: *Bacillus anthracis*
  - Zoonotic
  - In horses, pigs and dogs – pharyngeal and enteric disease
  - In ruminants – septicemic disease
Anthrax – Pathogenesis in ruminants:

- Ingestion / wound contamination / inhalation of spores
- Lymphangitis and localized lymphadenitis
- Massive bacteremia (sepsis) and toxemia
- Increased vascular permeability and impaired coagulation
- Sudden Death

- With sepsis, huge numbers of vegetative organisms in blood
- Become spores when exposed to air
  - Very resistant
  - Survive decades in soil
  - Infections often occur following soil excavation
Spleen – Inflammation

Anthrax - Lesions in ruminants
Spleen – Inflammation

Anthrax - Lesions in ruminants

Characteristic Findings:

• Bloated autolysed carcass with blood oozing from the orifices

• You aren’t supposed to necropsy suspect cases!!

• Take a blood smear from the ear!

• Methylene blue stain: Short chains of large bacilli with distinct pink capsule and square ends
Marked splenomegaly: Dark red to black, soft to semi-fluid spleen

Multifocal hemorrhage and edema in connective tissue

Thick tarry blood: fails to clot

Potential for bioterrorism?
Spleen – Inflammation

Chronic splenitis: Granulomatous splenitis

• Nodular granulomatous splenitis:

Images: Dr Fenton

• Diffuse granulomatous splenitis:

Histoplasmosis in a dog

Mycobacterium avium infection in a chicken

Dept of Veterinary Biosciences, The Ohio State University
### Growth disturbances

<table>
<thead>
<tr>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aplasia</td>
</tr>
<tr>
<td>Atrophy</td>
</tr>
<tr>
<td>Benign nodular hyperplasia</td>
</tr>
<tr>
<td>Lymphoid hyperplasia</td>
</tr>
<tr>
<td>Hyperplasia of the monocyte-macrophage system</td>
</tr>
<tr>
<td>Extramedullary hematopoiesis</td>
</tr>
</tbody>
</table>
Spleen – Disturbances of growth

Benign nodular hyperplasia

- Common finding in old dogs
- Usually incidental
- May predispose to splenic hematomas

Gross: Gray to red nodular mass(es): composed of lymphoid tissue and red pulp

Importance: Rule-out neoplasia
Lymphoid hyperplasia

- Hyperplasia of the white pulp
- Response to blood-borne antigen/chronic antigenic stimulation

Lymphoid follicles visible as 1 – 3 mm foci
Primary splenic neoplasia

Lymphoproliferative diseases:
Lymphoma/Leukemia*

Myeloproliferative diseases:
Histiocytic sarcoma*
Mastocytosis*

Hemangioma

Hemangiosarcoma

Others: Fibrosarcoma, Fibrohistiocytic nodules, etc

* Covered in primary hematopoietic neoplasia
Splenic hemangioma

- Benign tumour of endothelial origin

Gross: Single, soft, dark red nodular mass

This looks very similar to splenic hematoma and hemangiosarcoma! Histology is necessary!
Splenic hemangiosarcoma

• Most common malignant tumour of the canine spleen

Gross:
• Single to multiple, discrete to coalescing masses
• Often dark red
• +/- metastases
Splenic hemangiosarcoma

- Most common malignant tumour of the canine spleen

Histology:
- Blood-filled vascular spaces lined by anaplastic endothelial cells
Splenic hemangiosarcoma

- Most common malignant tumour of the canine spleen

Possible sequelae: Splenic rupture, hemoabdomen, peritoneal seeding, metastasis
- Often there are concurrent masses in the right auricle and liver
Metastatic splenic tumours: dog with pancreatic carcinoma

Spleen – Secondary (metastatic) neoplasia
Red Splenic Nodules

**Splenic nodules**

- Hematoma
- Hemangioma
- Hemangiosarcoma
- Splenic infarcts
- Incompletely contracted areas of the spleen
- Nodular hyperplasia (not always red)
# Diffuse Splenomegaly

<table>
<thead>
<tr>
<th>Diffuse splenomegaly with a bloody consistency = Bloody Spleens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septicemia</td>
</tr>
<tr>
<td>• Anthrax, Salmonella</td>
</tr>
<tr>
<td>Acute hemolytic anemia</td>
</tr>
<tr>
<td>Splenic torsion</td>
</tr>
<tr>
<td>Barbiturate euthanasia*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diffuse splenomegaly with a firm consistency = Meaty Spleens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septicemia</td>
</tr>
<tr>
<td>• Salmonella</td>
</tr>
<tr>
<td>Hemolytic disease</td>
</tr>
<tr>
<td>Lymphoma</td>
</tr>
<tr>
<td>Mast cell neoplasia</td>
</tr>
<tr>
<td>Histiocytic sarcoma</td>
</tr>
<tr>
<td>Granulomatous disease</td>
</tr>
<tr>
<td>• Histoplasmosis</td>
</tr>
<tr>
<td>Amyloidosis</td>
</tr>
</tbody>
</table>
Tonsils and Mucosa-Associated Lymphoid Tissue (MALT)

- Subject to similar disease processes as the LNs
- Constantly stimulated
- Important site of entry for pathogens
Questions?