Tutorial Module 6

Thoracic Cavity and Tumors of Lung and Pleura

Alfonso López

Atlantic Veterinary College
University of Prince Edward Island
Canada

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There are significant anatomical differences in the mediastinum of domestic animals: Bovines, like humans, have well-developed mediastinal separation between the left and right hemithorax, thus unilateral changes can occur. On the other hand, horses have poorly developed central mediastinum and a lesion in one side generally affects the contralateral hemithorax (bilateral lesions). Other species are somewhere in the middle.

This is a normal canine lung that collapsed when the thorax was opened and the negative thoracic pressure was lost.

Note that the lungs appear smaller than the thoracic cavity as illustrated by the red arrows.
The thoracic cavity normally contains small amounts of fluid sufficient to lubricate the lungs and avoid friction between visceral and parietal pleurae.

Normal pleura is thin and transparent.

- **Visceral pleura** lines the lungs.
- **Parietal pleura** lines ribs and intercostal muscles.

The most common abnormalities in the thoracic cavity are:

- **Pneumothorax** (Air)
- **Hydrothorax** (Fluid)
- **Hemothorax** (Blood)
- **Chylothorax** (Chyle)
- **Pyothorax** (Pus)

Note very thin pleural which makes the lung parenchyma clearly visible.
Pneumothorax refers to the loss of negative pressure in the thoracic cavity when air gains entrance to the thorax. Most common causes:

- Fractured Ribs
- **Gunshot Wounds (See Photo)**
- Iatrogenic-thoracocentesis-biopsy
- Ruptured Lung
- Ruptured Emphysematous Bulla
- Ruptured Parasitic Nodule
- Ruptured Esophagus or Diaphragm.

The postmortem diagnosis of Pneumothorax is difficult and cannot be accurately done if the animal has been dead for more than 6 hours. Quite often the diagnosis needs to be supported by history (i.e., trauma), clinical signs (i.e., respiratory distress) and radiographs.
To confirm pneumothorax during a postmortem examination, it is imperative to open the abdominal cavity before opening the thoracic cavity. Puncture carefully the diaphragm with a knife through the abdominal cavity. If the diaphragm retracts caudally, it indicates that negative thoracic pressure was present and therefore pneumothorax was not likely present. Conversely, if the diaphragm fails to retract and subsequent postmortem examination does not show evidence of pneumonia, emphysema or hydrothorax, this lack of diaphragmatic retraction is likely indicative of pneumothorax.

**Ruptured esophagus in a cat.** Note pockets of gas in the mediastinal tissue in a cat. This esophageal rupture caused by a foreign body allowed air to enter the mediastinum and thorax.
Hydrothorax

- **Transudate in thorax**

- **Etiology:**
  - Congestive heart failure
  - Hypoproteinemia:
    - Starvation
    - Renal disease
    - Intestinal disease
    - Lymphatic obstruction (neoplasia)

- **Sequels:**
  - Atelectasis
  - Chronic pleural irritation

Note thoracic cavity and syringe filled with transudate. In severe cases, hydrothorax results in compressive atelectasis and respiratory distress. Note that the lungs of this cat are collapsed (dark) because of the compression exerted by the thoracic fluid.
**Canine.** These organs belong to a dog with chronic heart failure that developed severe ascites and hydrothorax.

**Thoracic Cavity:** Note the fluid filling the thoracic cavity. Compressive atelectasis was also present which appears as dark, collapsed lungs (arrows).

**Abdominal Cavity:** Note abdomen filled with transudate.

**Heart:** Note endocarditis involving the aortic valve (arrow). This dog also had congestive heart failure. R = right; L = left.
Note a thoracic cavity filled with clotted blood (arrow). The thoracic cage of this animal was severely traumatized, causing the rupture of a major blood vessel. Careful dissection and postmortem examination are often required to locate the source of hemorrhage.

**Common causes of hemothorax are:**

- Trauma
- Ruptured aneurysm (dilation and weakening of a major vessel)
- Neoplasia
- Coagulopathies
This dog died suddenly and the owner suspected malicious poisoning. However, postmortem examination revealed pale mucous membranes (anemia) and the thorax filled with blood. Examination of great vessels revealed inflammation and a large aneurysm in thoracic aorta (arrow).

**Aorta:** Note the aortic wall notable corrugated (white arrow) as compared to the normal segment of the aorta (black arrows). **K= kidneys.** The aortitis and aneurysm in this dog was caused by *Spirocerca lupi* which migrates through an aortic wall.
Chylothorax

- Chylothorax is the accumulation of chylous fluid (free lymph) in a thoracic cavity.
- This chylous fluid is rich in:
  - Lymphocytes
  - Triglycerides
- Rupture of a major lymphatic vessel as a result of:
  - Trauma
  - Iatrogenic (surgery)
  - Neoplasia
  - Idiopathic

Note thorax filled with milky fluid. H= heart

Sometimes it is impossible to identify or locate the ruptured lymphatic vessels.
This is not my milk... it is chylous fluid removed from my chest by my Vet.
Chylothorax

Fluid obtained by thoracocentesis

Acute: Largely lymphocytes

Chronic: Lymphocytes and some neutrophils
Pleuritis and Pleuresy

- Pleuritis can occur alone or in combination with pneumonia.
- According to exudate:
  - Fibrinous
  - Purulent (suppurative)
  - Empyema
  - Granulomatous
- Chronic pleuritis typically results in pleural adhesions.
- Etiology: Most cases are infectious, although isolation is not always possible.

Fibrinous pleuritis characterized by extensive deposition of fibrin on pleural membranes
Pleuritis (Pleurisy) as part of Pleuropneumonia

Lung consolidation
Fibrinous Pleuritis (Pleurisy) / Horse

Note pleural surface covered by a thick layer of fibrin

Liver

There was no lung consolidation in this horse
Note massive accumulation of purulent exudate in a thoracic cavity. It has been postulated that empyema in cats originates from penetrating wounds (bites and scratches) contaminated with bacteria from oral flora.

There was no lung consolidation in this cat.
Pyothorax

Thoracocentesis: Dog

Cytology: Predominant population of neutrophils

Rebar AH Handbook of Veterinary Cytology. Ralston Purina 1978
Pleural Empyema (Pyothorax)

Note purulent exudate filling the entire thoracic cavity.
This "tomato soup" appearance is highly suggesting *Nocardia* infection. Histological lesions are those of a pyogranulomatous inflammation with many capillaries in the granulation tissue some of which rupture and leak RBCs, hence the hemorrhagic appearance.
Lung and Pleural Tumors

- Relatively rare in animals compared to human beings.
- More common in dogs and cats.
- According to cell line:
  - Epithelial (adenoma or carcinoma).
  - Mesenchymal (fibroma or fibrosarcoma / hemangioma or hemangiosarcoma).
- Most common malignant tumors in domestic animals:
  - Adenocarcinoma.
  - Bronchiolo-alveolar carcinoma.
  - Mesothelioma (pleura).
- Histopathology: Lung biopsy is the last diagnostic resource.
- Secondary tumors (metastatic) are very common in the lung.
Note large number of tumoral nodules infiltrating the lung. Based on gross appearance alone, it is not possible to determine whether this is a primary lung cancer or a secondary metastatic tumor originating elsewhere. Histopathology is always required.
Primary pulmonary carcinoma
Dog / Cut surface of fixed lung

Note the more or less well circumscribed area of pale discoloration which corresponds to the tumoral growth (arrows). Within this tumor you can appreciate a more solid mass closely associated to one bronchus which was presumably the primary tumor site (bronchogenic carcinomas).

The risk of lung cancer in humans has been unequivocally linked to cigarette smoke. Recent epidemiological studies revealed that the incidence of lung cancer continues to grow. Lung cancer has already replaced breast cancer as the number one malignancy in women.

Source unknown
Pulmonary Metastasis

Note metastatic tumoral nodules scattered in the pulmonary parenchyma.
Note lung filled with neoplastic nodules most of which have a depressed center giving the tumors an umbilicated appearance. This umbilicated appearance is mainly found in carcinomas and results from rapid tumoral growth and ischemic necrosis of the center.

The most common secondary (metastatic) tumors in the lung are renal, ovarian and mammary carcinoma, osteosarcoma, hemangiosarcoma and melanoma. Histopathology is required for confirmatory purposes.
Osteosarcoma often metastasizes to the lung (See next slide)
Metastatic Sarcoma
Hemangiosarcoma (lung metastasis)

Malignant Melanoma (lung metastasis)

Thyroid Carcinoma (lung metastasis)
Lymphoma (Lymphosarcoma) / Dog

Note enlarge tracheobronchial lymph nodes (arrows).
Mesothelioma is a rare tumor arising from the mesothelium of the peritoneal, pericardial or pleural serosal membranes.

Although metastasis to distal organs are rare, mesothelioma is easily implanted on contact between serosal surfaces, thus disseminating very rapidly within the cavity.

Inhalation of asbestos fibers has been linked to mesothelioma in human beings. Experimental exposure of laboratory animals to asbestos also results in the formation of mesothelioma.
I hate Pathology

Irrational thoughts commonly observed in students undergoing exam-induced stress.

Following graduation in the rapidly approaching summer of 2011, these uncontrollable feelings may progressively change into a more positive view of Pathology. Contrary to what has been said by some contemporary philosophers, you do not need to be insane to become a Veterinary Pathologist. Have a nice day!!
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If you have any comments, criticisms or suggestions about these tutorial modules please let me know.

Also, if you find any errors or typos please let me know too

lopez@upeica
The End