

Latin Comparative Pathology Group

The Latin Subdivision of the CL Davis Foundation

Diagnostic Exercise

Case #: 8 Month: April Year: 2011

Answer Sheet

Diagnosis:

Morphologic Diagnosis: Lung, acute cranioventral fibrinonecrotizing bronchopneumonia with fibrinous pleuritis.

Two possible causes: *Mannheimia haemolytica* (this case), *Histophilus somni*

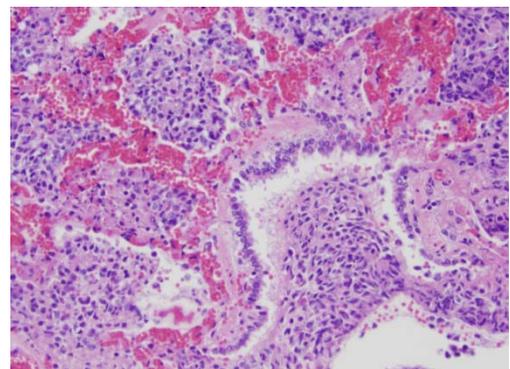
Typical Gross findings:

- Cranioventral lobar or lobular fibrinous bronchopneumonia
- Foci of coagulative necrosis
- Variable fibrinous pleuritis



Typical microscopic findings:

- Fibrinous and suppurative bronchopneumonia and pleuritis with necrosis of leukocytes and hemorrhage
- The necrotic leukocytes are often lytic and exhibit a streaming pattern of pale basophilic chromatin, termed "*oat cells*" for their resemblance to grains of oats
- Thrombi commonly occlude arterioles, venules, and alveolar septal capillaries with subsequent infarction



- Interlobular septa are distended with serofibrinous exudate, and fibrin
- Intralesional aggregates of gram-negative bacteria

Discussion:

Mannheimiosis is an infectious disease caused by the bacterium *Mannheimia haemolytica* characterized by acute fever, cranioventral fibrinonecrotizing bronchopneumonia and fibrinous pleuritis³. It is the main respiratory tract disease of cattle in North America, particularly in feedlots. The disease is also known as "shipping-fever" and affects large and small ruminants. The term "shipping-fever" is to emphasize that the disease occurs predominantly under circumstances of stress, especially during the transport of calves from farm of origin to the feedlot. The disease has a large economic impact on the beef industry in the U.S., with spending estimated at \$1 billion per year⁴. *Mannheimia haemolytica* is an opportunistic pathogen, normal resident bacterial flora of the nasopharynx and tonsils of cattle and sheep¹. Environmental or health factors that cause stress in animals and viral infections that cause immunosuppression and/or direct injury to the lung are the main factors in triggering the disease. These factors allow the flora of the upper respiratory tract to be installed in the lower respiratory tract causing disease.

The bacterium has virulence factors that promote colonization in the lung and immune system evasion. Of these, leukotoxin (exotoxin) and endotoxin (LPS) are most important¹. A recent article demonstrated that leukotoxin causes neutrophil extracellular trap (NET) formation by bovine neutrophils in a CD18-dependent manner. NETs formed in response to *M. haemolytica* are capable of trapping and killing a portion of the bacterial cells. Prior exposure of bovine neutrophils to LKT enhance subsequent trapping and killing of *M. haemolytica* cells in bovine NETs.⁵

The diagnosis in this case was made based on observations of macroscopic lesions, histopathology, associated with bacterial isolation from lung culture. Fibrinous pleuritis and bronchopneumonia in calves on feedlot, presence of oat cells in the microscopic, are highly suggestible of mannheimiosis.

Histophilus somni may also cause bronchopneumonia and fibrinous pleuritis. This form of disease is far less common compared to the thrombotic meningoencephalitis (TME) form. *Histophilus somni* most common manifestations are mutually exclusive in that animals affected with TME do not have concomitant respiratory disease¹. Additionally, oat cells are not a feature or respiratory *Histophilus somni* infection¹.

References and Recommended literature:

1. CASWELL, L. F.; WILLIAMS J. S. The respiratory system. In: Maxie M, ed. **Jubb, Kennedy & Palmer's pathology of domestic animals**. 6.ed. San Diego: Academic, 2007. v. 2, cap. 5, p. 601-605.
2. RICE, J. A. et al. *Mannheimia haemolytica* and bovine respiratory disease. **Anim Health Res Rev**, v. 8, p. 117-128, 2007.
3. SINGH, K.; RITCHEY, J. K.; CONFER, A. W. *Mannheimia haemolytica*: Bacterial-Host Interactions in Bovine Pneumonia. **Veterinary Pathology Online**, published on August 4, 2010.
4. WHITELEY, L. O. et al. *Pasteurella haemolytica* A1 and bovine respiratory disease: pathogenesis. **J Vet Intern Med**, v. 6, p. 11-22, 1992.
5. AULIK N.A., HELLENBRANDT K.M., KLOS H., et. al. *Mannheimia haemolytica* and its leukotoxin cause neutrophil extracellular trap formation by bovine neutrophils. **Infect Immun**. Nov;78(11):4454-66, 2010.

Please send your comments/questions to the whole LCPG list by hitting "reply to all".

A final document containing this material with answers and a brief discussion will be posted on the C. L. Davis website by the end of the current month (http://www.cldavis.org/lcpg_english.html).