Title: Bronchopneumonia associated with *Bordetella bronchiseptica* infection in a domestic rabbit.

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Figure 1. Thoracic and abdominal cavities, lateral view.
Figure 2. Lung. Hematoxylin and eosin; 2X (A), 10X (B) and 40X (C). Giemsa and Gram (inset) stains, 40X (D)

Diagnosis:

1) Microscopic description: The pulmonary parenchyma is effaced by coalescing areas of liquefactive necrosis characterized by numerous degenerate heterophils, abundant karyorrhectic cell debris, fibrin exudation, and gram-negative coccobacilli. The lumina of multifocal bronchioles and bronchi are filled with a similar exudate. The apical surface of the bronchial and bronchiolar epithelium is frequently lined by bacteria, accompanied by multifocal loss of cilia and epithelial attenuation. The remaining areas of the pulmonary parenchyma are comprised of alveolar spaces filled with edema fluid.

2) Morphologic diagnosis: Bronchopneumonia, heterophilic, coalescing, severe, acute to subacute, with intralesional gram-negative coccobacilli

3) Cause: *Bordetella bronchiseptica* (heavy growth obtained from lung tissue).

Typical gross findings:

- Purulent bronchopneumonia with a cranioventral distribution that can affect multiple lung lobes. The affected pulmonary parenchyma has multifocal to coalescing, red to tan areas of congestion and consolidation. Associated pleuritis occurs occasionally.
• Mucopurulent exudate within upper airways including nasal passages, trachea and tympanic bullae.
• Mucopurulent crusts around the eyes.

Typical microscopic findings:

• Suppurative bronchopneumonia that tends to extensively affect the pulmonary parenchyma.
• The respiratory epithelium lining bronchioles and bronchi may be coated by a layer of gram-negative coccobacilli that can be highlighted using a Giemsa or silver stain.
• Occasional necrotizing tracheitis.

Discussion:

*Bordetella bronchiseptica* is a gram-negative coccobacillus present in the upper respiratory tract of dogs, cats and other domestic animal species. *B. bronchiseptica* has the ability to cause tracheobronchitis and pneumonia in a large variety of species, including dogs, cats, rabbits, pigs, humans, and several species of rodents. While *B. bronchiseptica* typically causes a self-limiting tracheobronchitis, it can cause fatal suppurative bronchopneumonia in susceptible animals. Interestingly, expression of virulence factors is dependent on environmental conditions and is regulated by the expression of the *Bordetella virulence gene* (bvg) operon. Initial infection is mediated by expression of specific bvg operon genes, including fimbriae, filamentous hemagglutinin (FHA) and pertactin, which mediate attachment to the respiratory cilia. These adhesion factors allow the bacterium to adhere to ciliated epithelial cells (causing ciliostasis) and to neutrophils and macrophages. Following the attachment phase, additional bvg-regulated virulence genes are expressed, such as exotoxins. Among these, the adenylate cyclase toxin is an RTX (repeats in toxin) family toxin with similarities to the leukotoxin and Apx toxins of *Mannheimia haemolytica* and *Actinobacillus pleuropneumoniae*, respectively, that mediate pore formation in target cell membranes and transfer of the adenylate cyclase component that, in turn, leads to intracellular increase in cAMP with disruption of cellular phagocytosis and intracellular killing mediated by oxidative burst. *B. bronchiseptica* has a greater effect on younger animals, impacting rabbits most significantly at 4–6 weeks of age, puppies at 7–35 weeks of age, and kittens less than 12 weeks of age. Guinea pigs and rabbits are particularly susceptible to *B. bronchiseptica*. It is therefore recommended to avoid housing guinea pigs and rabbits together or within close quarters to avoid transmission of the bacterium. Differential diagnoses include *Pasteurella multocida, Staphylococcus aureus, Streptococcus pneumoniae, Streptococcus equi* subsp. *zooepidemicus*, and *Klebsiella pneumoniae*.5
References and Recommended literature:


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