

Bovine Pulmonary Physiology and Emphysema

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History:

Pulmonary emphysema refers to an excessive abnormal permanent accumulation of air in the lungs. Historically, bovine emphysema has been directly associated with acute bovine pulmonary emphysema or fog fever which is caused by pneumotoxins from the L-tryptophan of rich forage. Currently, based on the physiology of the bovine lung, other consideration should be investigated before a final diagnosis of fog fever is recorded. Bovine emphysema is usually interstitial and a secondary condition.

Bovine Lung Physiology Review:

The bovine lung is distinguished by the very thick connective tissue septa that separate areas on the surface and extend inward to divide the lung substance into segments. The septa, which may help to localize infection, become even more obvious in certain diseases in which they are thickened and edematous. The capacity for respiratory exchange is limited, when compared to other species, by the relatively small total alveolar surface area and lesser density of capillaries. A larger part of the lung capacity in the bovine is required for basal needs leaving little lung reserve available in stressful circumstances.

Understanding the physiology of the bovine lung is key to understanding the bovine susceptibility to lung disease, the development of emphysema and the economic impact that it has on the industry.

Pathogenesis:

Pulmonary emphysema can be divided into two broad categories, alveolar and interstitial. In alveolar emphysema the alveoli are distended by excessive amounts of air pressure and often times rupture.

In interstitial emphysema the air accumulates in the sub-pleural, interstitial, and intralobular regions of the lungs.

The pathogenesis of interstitial emphysema is not fully understood but there are at least two possibilities:

- 1.) There may be degradation and weakening of the interstitium by proteolytic enzymes, particularly elastase released by inflammatory cells.
- 2.) Emphysema develops secondary to either chronic bronchitis or bronchiolitis which causes obstruction of airways on expiration due to exudates plugging airway passages. This causes airway imbalance where the volume of air entering exceeds the volume of air leaving the lung. (A "check valve" lesion in which air is still able to enter alveoli on inspiration but is unable to leave freely.)

Clinical Signs:

Since bovine emphysema is usually a secondary condition, the clinical signs are that of the primary cause of the emphysema. Most lung diseases in cattle have similar clinical

signs. The cattle are depressed, lethargic, slow to the bunk, may have nasal discharge, and dyspnea.

Diagnosis:

Acute bovine pulmonary emphysema is often over diagnosed by the emphysematous lesions in the lungs at necropsy. It must be considered that bovine emphysema can have iatrogenic causes such as from abdominal surgery or lesions from pulmonary alveolar rupture, gas gangrene, puncture wound, or from the final breaths and agonal changes just prior to and at death. Keep in mind that bovine emphysema is usually interstitial and a secondary condition. The most common primary causes of bovine emphysema are the infectious and inflammatory diseases.

Auscultation of emphysematous lung will demonstrate decreased intensity to the breath sounds. There may be wheezing sounds on expiration. Thoracic percussion characteristics in emphysema or when there is trapped air include sounds that have a long duration, low pitch, a loud intensity with only slight elasticity.

Prevention:

To prevent emphysema one must focus on preventing the primary cause of the emphysema.

Treatment:

There is no treatment for emphysema. The clinician can only treat the primary cause early in the disease course in attempt to prevent the development of emphysema in cattle.

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