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Lecture title: **PNEUMONIC PASTEURELLOSIS OF CATTLE (SHIPPING FEVER PNEUMONIA)**

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Summary:

ETIOLOGY

Mannheimia (Pasteurella) haemolytica biotype A serotype 1 is the most common cause of the pneumonia
M. haemolytica serotypes 6, 2, 9, and 11 serotypes have been found in lesions of pneumonic pasteurellosis

- The *Pastcurella* spp. are the final cause of the pneumonia but the mechanisms by which the bacteria enter and colonize the lung and produce the lesions are complex andunclear.
- Viruses or mycoplasmas may act synergistically to allow the bacteria to be pathogenic.

There is often a history of stressors such as:

- Transportation
- Mixing of groups of cattle from
- different sources
- Confinement of cattle
- Ineffective housing and ventilation

EPIDEMIOLOGY
Occurrence

Pneumonic pasteurellosis is a common disease of young growing cattle in Europe, the UK, and North America. The disease occurs most commonly in recently weaned beef calves 6-8 months of age shortly after being placed into feedlots in the fall of the year.

Nursing beef calves, yearlings, and mature dairy and beef cows may also be affected, but less frequently. Pneumonic pasteurellosis, also known as shipping fever, is an entity within the bovine respiratory disease complex, characterized clinically by acute bronchopneumonia with toxemia.

The morbidity may reach 35%, the case fatality rate may range from 5-10%, The peak incidence of disease occurs within the first 3 weeks after arrival of the calves in the feedlot. The most common clinical and pathological diagnosis was respiratory disease, often described as shipping fever.

Risk factors

Animal risk factors

The disease occurs most commonly in young growing cattle from 6 months to 2 years of age but all age groups are susceptible. The calves may develop the disease before weaning if subjected to the stress of an early snowstorm in the late fall in Canada.

The disease occurs commonly in outbreaks 7-10 days after cattle have arrived in the feedlot following stressful transportation.

Although the disease occurs most commonly in young beef cattle soon after their introduction to feedlots it is not uncommon in dairy herds, especially when recent introductions have been made or cattle are returned to their home farms after summer grazing on community pastures or exhibition at fairs.

Environmental and management risk factors

The mixing of cattle from different sources is an important risk factor, Confinement in drafty or humid and poorly ventilated barns, exposure to inclement weather, transport, fatigue and deprivation from feed and water are commonly followed by outbreaks of the disease in cattle.

Pathogen risk factors

The virulence factors of *M. haemolytica* include:
Fimbriae, polysaccharide capsule, outer membrane proteins, endotoxin (lipopolysaccharide), and leukotoxin

M. haemolytica serotypes Al and A2 can survive for long periods of time.

Both strains survived for at least 244 days in ovine and 156 days in bovine tracheobronchial washings, respectively.

This may provide an explanation for the long survival of the organism in the nasopharynx
of ruminants.

Methods of transmission

Transmission of *pasteurella* probably occurs by the inhalation of infected droplets coughed up or exhaled by infected animals, which may be clinical cases or recovered carriers in which the infection persists in the upper respiratory tract. When conditions are optimal, particularly when cattle are closely confined in inadequately ventilated barns, or when overcrowded in trucks and trains, or held for long periods in holding pens
in feedlots, the disease may spread very quickly and affect a high proportion of the herd within 48 hours. In animals at pasture, the rate of spread may be much slower.

PATHOGENESIS

Colonization of upper and lower respiratory tracts

Under normal conditions the bovine lung is relatively free of pasteurellas because of an effective lung clearance mechanism. The current hypothesis is that a combination of a viral infection of the respiratory tract and/or devitalizing influences from transportation, temporary starvation, weaning can promote an increase in the total numbers and virulence of pasteurellas in the nasopharynx, which then enter the lung. In clinically normal cattle, *M. haemolytica* are present in low numbers in the tonsil and nasal passages.

Exposure of healthy cattle to stressors such as viral infection, change in management practices and environmental changes leads to an explosive growth and selective colonization by *M. haemolytica* A1 in the upper respiratory tract.

Virulence factors and cellular and humoral reactions:

Four virulence factors have been associated with *M. haemolytica*:

- Fimbriae
- A polysaccharide capsule
- Endotoxin (lipopolysaccharide)
- Leukotoxin

Fimbriae enhance the colonization of the upper respiratory tract. The polysaccharide capsule of the organism inhibits complement-mediated serum killing as well as phagocytosis and intracellular killing of the organism.

The lipopolysaccharide or endotoxin can alter bovine leukocyte functions and is directly toxic to bovine endothelium.

Leukotoxin is one of the major virulence factors of *M. haemolytica* responsible for impaired function of neutrophils, and also induces histamine release from bovine mast cells.

Death is due to hypoxemia and toxemia. Complications include pulmonary abscessation, chronic pleuritis with or without pleural effusion, bronchiectasis, pericarditis and, rarely, congestive heart failure due to cor pulmonale.

CLINICAL FINDINGS

1. The affected animals have fever of 40-41°C
2. Bilateral mucopurulent nasal discharge
3. Gaunt abdomen with rumen atony,
4. Coughing, varying degrees of polypnea and dyspnea, and evidence of bronchopneumonia
5. In the early stages there are loud breath sounds audible over the anterior and ventral parts of the lungs, as the disease progresses these breath sounds become louder and extend over a greater area
6. Crackles become audible, followed by wheezes in a few days, especially in chronic cases.
7. Pleuritic friction rubs may be audible
8. In severe cases the dyspnea is marked, commonly with an expiratory grunt.
9. The course of the disease is only 2-4 days. In severe cases and those that have been ill for a few days before being treated may die or become chronically affected
10. Calves may be affected with pneumonia and young calves may die of septicemia without having shown previous signs of illness.

CLI NICAL PATHOLOGY

- **Bacterial culture:**

Nasal swabs taken from clinical cases before treatment often yield a pure culture of pasteurellas, also nasopharyngeal swabs and bronchoalveolar lavage can be used for bacterial culture

- **Hematology :**

Plasma fibrinogen concentrations are elevated. Acute phase proteins are increased within 24 hours following experimental intratracheal inoculation of *M. haemolytica* into calves

NECROPSY FINDINGS

There is marked pulmonary consolidation. The stage of pneumonia varies within the affected tissue, commencing with congestion and edema and passing through various stages of airway consolidation with serofibrinous exudation in the interlobular spaces. catarrhal bronchitis and bronchiolitis, and a fibrinous pleuritis are usually present and may be accompanied by a fibrinous pericarditis. The lung is firm and the cut surface usually reveals an irregular, variegated pattern of red, white, and gray tissue due to hemorrhage, necrosis, and consolidation. Coagulation necrosis of pneumonic lungs is the most characteristic lesion in pneumonic pasteurellosis.

TREATMENT

1. Antimicrobial therapy:

oxytetracycline, tilmicosin, trimethoprim-sulfadoxine, and the sulfonamides. Broad spectrum antimicrobials are used most commonly

2. Anti-inflammatory agents Corticosteroids and nonsteroidal anti-inflammatory drugs (NSAIDs) are used by some veterinarians as an ancillary, treatment for severe cases

Failure to respond:

The causes of failure to respond to therapy include:

- Advanced pneumonia before treatment is initiated
- Presence of viral or interstitial pneumonia or some other pneumonia that is not responsive to antimicrobials
- Inadequate dose of antimicrobials
- Antimicrobial resistance of the bacteria
- Complications such as pulmonary abscess, bronchiectasis, and pleuritis.

CONTROL

Satisfactory economical control of the disease depends on the successful integration of management and perhaps the use of vaccines and antimicrobials prophylactically

- Management strategies: Preconditioning programs
- Vaccines

In Feedlot cattle should be vaccinated twice at a 14-day interval with the *M. haemolytica* bacterial extract and genetically attenuated leukotoxin vaccine, with the second dose at least 14 days before arrival in the feedlot.