CONTAGIOUS CAPRINE PLEUROPNEUMONIA

- an acute highly contagious disease of goats caused by a Mycoplasma F38 biotype, characterized by fever, coughing, severe respiratory distress, and high mortality.
- The principal lesion at necropsy is fibrinous pleuropneumonia.

**Aetiology and epidemiology**
- Two organisms have been reported as the causative agents for contagious caprine pleuropneumonia (CCPP).
  - *Mycoplasma capricolum capripneumoniae*, commonly known as Mycoplasma biotype F38, is the most contagious and virulent of the two.
  - *Mycoplasma mycoides capri* (type PG-3) also appears to cause the disease in goats, although much less commonly and with somewhat different signs.
  - Other mycoplasma organisms can cause pneumonia in goats, but are not considered to cause CCPP.
    - M. mycoides mycoides large colony type.

**Geographic Distribution**
- CCPP found in:
  - Africa
  - Middle East
  - Eastern Europe
  - Former USSR
  - Far East
- Never been found in North America

**Morbidity/Mortality**
- Morbidity often 100%
- Mortality ranges from 60-100%
- Influencing factors
  - Close confinement
  - Type of Mycoplasma
    - Strain F38
    - M. mycoides capri
Animal Transmission

- Incubation period: 6-10 days or 3-4 weeks
- Direct contact
  - Inhalation of infected respiratory droplets
- F38 strain more contagious
- Carrier animals
  - Shed more organisms
    - Stress, sudden changes in climate

Clinical Signs

- *Mycoplasma* F38 strain
  - Respiratory symptoms
    - Coughing, labored respiration
  - High fever, lethargy, anorexia
  - Nasal discharge - frothy
  - Stringy saliva
  - In acute disease, which occur in fully susceptible goats, death occurs within 7 to 10 days after the onset of clinical signs.

Clinical Signs

- *M. mycoides capri*
  - Septicemia
  - Generalized infection
  - Reproductive, GI, respiratory symptoms
  - Less contagious than F38-induced disease,
  - The mortality and morbidity rates are also lower.

Post Mortem Lesions:

*Mycoplasma F38*

- Limited to lungs (one or both)
  - Granular appearance,
  - Fibrinous pneumonia
  - Straw-colored fluid in thorax
  - Pea-sized yellow nodules on lungs
  - Congestion around the nodules
  - Adhesions to chest wall
    - Thickened pulmonary pleura
### Post Mortem Lesions

*M. mycoides capri*

- Encephalitis, meningitis
- Lymphadenitis, splenitis
- Genitourinary tract inflammation
- Intestinal lesions
- Lung lesions
  - Resemble contagious bovine pleuropneumonia
  - Often unilateral
  - Fibrinous pneumonia

### Diagnosis

**Clinical and Differential**

- Suspect CCPP with
  - Severe respiratory disease
  - High morbidity and mortality
  - Characteristic postmortem lesions
- Differential
  - Other causes of pneumonia
    - Pasteurellosis
    - Peste des petits ruminants (PPR)

### Sampling

- Before collecting or sending any samples, the proper authorities should be contacted
- Samples should only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease

### Diagnosis: Laboratory

- Isolation/identification of organism
  - Immunofluorescence
  - Culture Isolation
  - PCR
- Serology
  - Used for herd diagnosis
    - Complement fixation
    - Passive hemagglutination
    - ELISA
BOVINE TUBERCULOSIS

- Although bovine tuberculosis was once found worldwide, control programs have eliminated or nearly eliminated this disease from domesticated animals in many countries.
- Nations currently classified as tuberculosis-free include Australia, Iceland, Denmark, Sweden, Norway, Finland, Austria, Switzerland, Luxembourg, Latvia, Slovakia, Lithuania, Estonia, the Czech Republic, Canada, Singapore, Jamaica, Barbados and Israel.
- Eradication programs are in progress in other European countries, Japan, New Zealand, the United States, Mexico, and some countries of Central and South America.
- Although bovine tuberculosis has been eradicated from the majority of U.S. states, a few infected herds continue to be reported, and a few states may periodically lose their disease-free status.
- In particular, a focus of infection in wild white-tailed deer has complicated eradication efforts in Michigan. Similar problems exist with infected badgers in the U.K. and Ireland, and infected brush-tailed opossums in New Zealand.
- Bovine tuberculosis is still widespread in Africa, parts of Asia and some Middle Eastern countries.

Mycobacterium

- *M. bovis* can survive for several months in the environment, particularly in cold, dark and moist conditions.
- At 12-24°C (54-75°F), the survival time varies from 18 to 332 days, depending on the exposure to sunlight.
- This organism is infrequently isolated from soil or pastures grazed by infected cattle.
**Mycobacterium**

- **Resistant**
  - To drying (6-8 months in sputum)
  - To acids (3% HCl, 6% H$_2$SO$_4$)
  - To alkalis (4% NaOH)
  - Can remain viable for extended periods in cold weather

- **Sensitive**
  - To moist heat (60 °C – 30 min; 70 °C – 3 min)
  - Disinfectants (Alcohol, formalin, gluteraldehyde)
  - Drugs (rifampin, paraaminosalicylic acid, streptomycin, isoniazid, pyrazinamide)
  - Can be killed by a weak solution of common household bleach (1 part bleach to 9 parts water)
  - UV light

**Transmission**

- Tuberculosis can be transmitted either by the respiratory route or ingestion.
- In cattle, aerosol spread is more common.
- Other routes Cutaneous, Genital, and Congenital infections have been seen but are rare.
- Infectious bacteria can be shed in the respiratory secretions, feces, milk, and in some individuals in the urine, vaginal secretions, or semen.
- Not all infected animals transmit the disease.

**PATHOGENESIS**

- By ingestion of contaminated feed & water > Localize at point of entry > produce typical tubercle in associated organs & lymph nodes (pharyngeal & mesenteric L.N)
- By inhalation > enter alveoli > mucosa of bronchial tree > neutrophilic infiltration > undergo necrosis & macrophages accumulates > form multilayer zone around bacteria & dead cells >
- Some epitheloid cells fuse > form langhan's giant cells
- Some bacilli destroyed & phagocytosed > zone of lymphocyte & fibrous C.T. form around epithelial cells > caseous necrosis > Ca-salt deposits in foci of necrotic tissue > some foci of infection coalesce > form tubercles > healing of primary lesion may take place >
- Some bacilli may come out > invade lymph channels > lymph nodes (bronchial & mediastinal) > bacilli enter lymphatics in pleural surface > tuberculous pleuritis

- **Mycobacterium bovis** (bovine)
- **Mycobacterium avium** (bird)
- **Mycobacterium tuberculosis** (human)
STAGES OF PATHOGENESIS

1. Primary stage (localize at point of entry > produce lesion)
2. Post primary dissemination - extend to body cavities, blood vessels, lymph nodes
3. Stage of generalization-extensive lesion due to low host resistance

Key Steps in TB Pathogenesis

- Bacteria get into the cell
- Bacteria survive in phagocytes
  - Avoidance of activated macrophage response
- Bacteria thrive in phagocytes
  - How to make the macrophage your home
- Bacteria apparently wait it out
- Tissue destruction

CLINICAL FINDINGS

- Referable to site of localization
- Tuberculosis is usually a chronic debilitating disease in cattle, but it can occasionally be acute and rapidly progressive.

RESPIRATORY SYSTEM

- In the late stages, common symptoms include progressive emaciation,
- a low-grade fluctuating fever,
- weakness and in-appetence.
- have a moist cough that is worse in the morning, during cold weather or exercise, and may have dyspnea or tachypnea.
- In the terminal stages, animals may become extremely emaciated and develop acute respiratory distress.
- In some animals, the retropharyngeal or other lymph nodes enlarge and may rupture and drain.
- Greatly enlarged lymph nodes can also obstruct blood vessels, airways, or the digestive tract.

LESIONS

- Tubercles b/w 1-2 mm diameter on different organs.
- Commonly affected organs are lungs, liver, pleura, peritoneum, kidney, spleen regional L.Ns & glands.
- Some cases; bones, joints, C.N.S. .
- Occasionally; male and female Genital organs.
- Tubercle deep in soft tissues or bulging from mucus serous surface.
- Tubercle – firm, hard, white, grey or yellowish nodule.
- Calcification common in bovine.
- Tuberculous lesion consist of caseous core, surrounded by necrotic tissue, encapsulated with fibrous tissues.
- Nodules on pleura & peritonium.
- Lesions may enlarge involving whole lungs, liver, or small & numerous (milliary TB)
- T.B lesion may persist for entire life

HISTOPATHOLOGY

- Characteristic Microscopic lesion is tubercle.
- Caseous necrosis in centre encircled by epitheloid cells, lymphocytes.
- Calcification in caseous centre of necrosis
- Langhan’s giant cells - pale acidophilic cytoplasm and no. of round neutrei arranged in crescent at corner + lipid droplets + bacilli.

Diagnosis

- Comparative Cervical Tuberculin Test (CCTT)
- Tuberculin results

<table>
<thead>
<tr>
<th>Increase in Skin Thickness</th>
<th>Result</th>
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<tbody>
<tr>
<td>&lt;3.0 mm</td>
<td>Negative</td>
</tr>
<tr>
<td>3-3.9 mm</td>
<td>Suspected</td>
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<tr>
<td>4 or &gt;4mm</td>
<td>Positive</td>
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**Diagnosis**
- gross examination
- histological (microscopic) examination
- ZN staining and isolation of organism on Stonebrink’s medium

**Histopathology**
- Most common lesion associated with bovine TB is the granuloma

**ZN Staining**

**Culture**
- *Stonebrink’s medium*
- Culturing usually takes 8 to 16 weeks
Polymerase Chain Reaction (PCR)

- Used to detect the presence of DNA that is specific to the organism
- PCR amplifies the specific portion of DNA
- The product can be easily visualized by gel electrophoresis
- PCR is very sensitive
  - Can detect organism even when present at very low levels