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Contagious Caprine Pleuropneumonia

Mycoplasma capricolum subspecies *capripneumoniae*

Contagious caprine pleuropneumonia (CCPP) is also known as *Mycoplasma capricolum* subspecies *capripneumoniae* (formerly *Mycoplasma* strain F38).

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Overview

- Organism
- Economic Impact
- Epidemiology
- Transmission
- Clinical Signs
- Diagnosis and Treatment
- Prevention and Control
- Actions to Take

In today's presentation we will cover information regarding the organism that causes contagious caprine pleuropneumonia and its epidemiology. We will also talk about the economic impact the disease has had in the past and could have in the future. Additionally, we will talk about how it is transmitted, the species it affects, clinical signs and necropsy findings, and diagnosis and treatment of the disease. Finally, we will address prevention and control measures for the disease as well as actions to take if contagious caprine pleuropneumonia is suspected. [Photo: Goat. Source: James DeMers/Pixabay.com-public domain]

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THE ORGANISM

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Contagious Caprine Pleuropneumonia (CCPP)

- *Mycoplasma capricolum* subsp. *capripneumoniae*
  - Formerly known as biotype F38
  - Four lineages
  - Other mycoplasmas cause similar but distinct disease in small ruminants

Contagious caprine pleuropneumonia (CCPP) is caused by *Mycoplasma capricolum* subspecies *capripneumoniae* (formerly known as *Mycoplasma* biotype F38). There are four lineages which correspond to geographic regions. *M. capripneumoniae* belongs to a closely related group of mycoplasmas called the *Mycoplasma mycoides* cluster. Two other organisms in this group, *M. mycoides* subsp. *capri* and *M. mycoides* subsp. *mycoides* large-colony type, can cause a disease in small ruminants that resembles CCPP but may have extrapulmonary signs and lesions. At one time, some authors also considered these organisms, particularly *M. mycoides* subsp. *capri*, to cause CCPP. However, these diseases are now considered to be distinct. [Photo: Plate culture of *Mycoplasma* organisms. Source: University of Alabama at Birmingham Diagnostic Mycoplasma Laboratory at http://www.mycoplasma.uab.edu/Methodologies.html]

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IMPORTANCE

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History

- 1873: First described in Algeria
- 1881: Major outbreak in South Africa
  - Diseased goats led to spread
  - Discovery that CCPP is highly infectious
- 1976: *Mycoplasma* F38 isolated
  - *In vitro*
- 1993: Officially classified as *M. capricolum* subsp. *capripneumoniae*

CCPP was first described in 1873 in Algeria. It was not initially recognized as contagious because the disease was endemic in most of the regions examined; climate conditions were instead blamed for disease outbreaks. In 1881, there was a major outbreak in South Africa following the introduction of diseased goats coming from Turkey, and this led to the conclusion that CCPP was highly infectious. In 1976, *Mycoplasma* F38 was isolated for the first time *in vitro*, and was officially named *M. capricolum* subspecies *capripneumoniae* in 1993.

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Economic Impact

- Large goat industries: Africa, Asia
  - Goat commodities: meat, milk, hides
- Direct costs
  - High mortality rates
  - Reduced milk and meat production
  - Treatment and control costs
- Indirect costs
  - Trade restrictions

Goats are important commodities providing meat, milk, and hides, especially in Africa and Asia. There, CCPP is a disease of major economic importance. CCPP has both direct and indirect effects on goat production. High mortality rates, reduced milk and meat production, and the costs of diagnosis, treatment, and control all have a direct effect on the goat industry. There are also indirect losses due to the implementation of trade restrictions.

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EPIDEMIOLOGY

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Geographic Distribution

- CCPP endemic in:
  - Africa
  - Asia
  - Middle East
  - Eastern Europe
  - Former USSR
- Never been found in North America

CCPP can be found in Africa, Asia, the Middle East, Eastern Europe, and the former Soviet Union. It has never been found in North America.

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Morbidity/Mortality

- Morbidity
  - Often 100%
  - Disease severe in naïve animals
  - Chronic disease in endemic areas
- Mortality
  - Ranges from 60 to 100%
  - Increased with close contact

CCPP is severe and highly contagious in naive animals; morbidity is often 100%. Chronic disease can also be seen in endemic areas where animals may have pre-existing immunity to *M. capripneumoniae*. Mortality ranges from 60 to 100%. Close confinement increases the spread of disease.

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TRANSMISSION

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Animal Transmission

- Incubation period: 6 to 10 days
- Highly contagious
- Direct contact
  - Inhalation of infectious respiratory droplets
- Carrier animals may exist

The incubation period is often 6 to 10 days, though it is sometimes as long as 3 to 4 weeks under natural conditions. CCPP is highly contagious. Transmission of CCPP is by direct contact through inhalation of infectious respiratory droplets. Chronic carriers may exist, but this remains unproven.

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ANIMALS AND CCPP

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Clinical Signs

- Respiratory symptoms
  - Peracute
    - Minimal clinical signs
  - Acute
    - High fever, anorexia, productive cough, wide stance, extended neck
  - Chronic
    - Cough, nasal charge, debilitation

CCPP is strictly a respiratory disease. Peracute, acute and chronic forms may be seen in endemic areas. Peracutely affected goats can die within 1 to 3 days with minimal clinical signs. In acute disease, the initial signs are a very high fever, lethargy and anorexia, followed within 2 to 3 days by coughing and labored respiration. The cough is frequent, violent and productive. In the final stages of disease, the goat may not be able to move and stands with its front legs wide apart, and its neck stiff and extended. Chronic CCPP is characterized by a chronic cough, nasal discharge, and debilitation.

[Photos: (Top) Purulent nasal discharge. Source: Ibrahim H. 1999. Diseases of economic importance in small ruminants in sub-Saharan Africa at http://www.cglrc.cgiar.org/ilri/diseasesSubSaharanILRI/Part_A_Diagnosis_of_diseases/Contagious_caprine_pleuropneumonia_%28CCPP%29.htm; (Bottom) Debilitated goat. Source: U.S. Department of Agriculture]

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Post Mortem Lesions

- Granular lung appearance
- Fibrinous pneumonia
- Chronic changes
  - Pleuropneumonia
  - Pleuritis
  - Adhesions

The lesions of CCPP are limited to the respiratory system. Typical post mortem findings with CCPP infections include the granular appearance of one or both lungs (top photo) and fibrinous pneumonia, in which the lung is covered with fibrin and there is excessive fluid in the thoracic cavity (bottom photo). Some long-term survivors have chronic pleuropneumonia or chronic pleuritis, with encapsulation of acute lesions and numerous adhesions to the chest wall.

[Photos: (Top) Interlobular thickening in lung; (Bottom) lung covered in fibrin. Source: International Veterinary Information Service at www.ivis.org]

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Differential Diagnosis

- Pasteurellosis
- Peste des petits ruminants
- Caseous lymphadenitis
- *Mycoplasma mycoides* subsp. *capri*
- *Mycoplasma mycoides* subsp. *mycoides* large-colony type

Differential diagnoses includes pasteurellosis and other forms of bacterial pneumonia, peste des petits ruminants and caseous lymphadenitis. Some other mycoplasmas, particularly *Mycoplasma mycoides* subsp. *capri* and *Mycoplasma mycoides* subsp. *mycoides* large-colony type, can also cause pleuropneumonia resembling CCPP.

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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

Before collecting or sending any samples from animals with a suspected foreign animal disease, the proper authorities (state and/or federal veterinarian) should be contacted. Samples should only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease.

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Diagnosis: Laboratory

- Clinical – severe respiratory distress
- Isolation/identification
  - Immunofluorescence
  - Growth or metabolic inhibition tests
  - PCR
- Serology
  - Complement fixation
  - Passive hemagglutination
  - ELISA

CCPP should be suspected when severe respiratory disease, with a high morbidity and mortality rate, is seen in goats. Definitive diagnosis is made by isolation and identification of the organism. Immunofluorescence, growth or metabolic inhibition tests, and polymerase chain reactions (PCR) can also be used for identification. Serological tests include complement fixation, latex agglutination, indirect hemagglutination and enzyme linked immunosorbent assays (ELISA). Serological tests are generally used on a herd basis and not for individual diagnosis. These tests do not identify all reactors, and cross-reactions occur with other species in the *M. mycoides* cluster.

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Treatment

- Antibiotics
  - Erythromycin, tylosin, tetracycline, streptomycin
  - Early intervention and treatment needed
- Newly infected countries
  - Trade, movement restrictions
  - Slaughter of infected animals

Antibiotics can be helpful in the treatment of CCPP; erythromycin, tylosin, tetracycline, or streptomycin are recommended but their success depends on early intervention and treatment. In countries that are newly infected, trade and movement restrictions and the slaughter of infected animals is recommended.

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CCPP IN HUMANS

Humans are not susceptible

Humans are not susceptible to contagious caprine pleuropneumonia infection.

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PREVENTION AND CONTROL

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Recommended Actions

- IMMEDIATELY notify authorities
- Federal
  - Area Veterinarian in Charge (AVIC)
    http://www.aphis.usda.gov/animal_health/area_offices/
- State
  - State veterinarian
    http://www.usaha.org/stateanimalhealthofficials.aspx
- Quarantine

If you suspect a case of CCPP, state or federal authorities should be notified immediately. Animals suspected with CCPP should be isolated, and the farm should be quarantined until definitive diagnosis is determined.

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Quarantine and Disinfection

- Quarantine
  - Desirable for infected flocks
  - Strict, due to communicability
- Disinfection
  - Sodium hypochlorite (bleach)

Quarantine of infected flocks is desirable, and on-site testing and slaughter is sometimes necessary to control the spread of CCPP (Top photo: courtesy of Katie Steneroden, ISU). The quarantine must be strictly imposed due to the high communicability of the disease. Sodium hypochlorite (bleach) containing a stock concentration of 5.25% available chlorine is effective for disinfection, and a 0.1% concentration is prepared by adding 30mL of bleach to 10 gallons of water.

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Vaccination

- Vaccines available in some countries
  - Good/excellent protection
- We all need to do our part
  - Keep animals healthy
  - Free of foreign animal diseases

Vaccines are available in some countries and have been reported to provide good to excellent protection. We all need to do our part to keep our animals healthy and free of foreign animal diseases such as contagious caprine pleuropneumonia.

[Photo: Goat. Source: Wikimedia Commons]

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Additional Resources

- World Organization for Animal Health (OIE)
  - www.oie.int
- U.S. Department of Agriculture (USDA)
  - www.aphis.usda.gov
- Center for Food Security and Public Health
  - www.cfsph.iastate.edu
- USAHA Foreign Animal Diseases ("The Gray Book")
  - http://www.aphis.usda.gov/emergency_response/downloads/nahems/fad.pdf

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