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**Contagious Bovine  
Pleuropneumonia**



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**Overview**

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



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In today's presentation we will cover information regarding the organism that causes contagious bovine 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 bovine pleuropneumonia is suspected.

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**The Organism**



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**Contagious Bovine  
Pleuropneumonia (CBPP)**

- *Mycoplasma mycoides mycoides*
  - Small colony type
  - Quickly inactivated in environment
  - Does not survive in meat or meat products
- Natural hosts:
  - Bovine and zebu



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*Mycoplasma mycoides mycoides* small colony type (SC type) bacteria are the causative agent of contagious bovine pleuropneumonia (CBPP). (*M. mycoides mycoides* large colony type is the causative agent of contagious caprine pleuropneumonia, and does not affect cattle). CBPP is extremely infectious in cattle, and causes lung and occasionally joint disease. The genus *Bos* including bovine (left photo) and zebu (a group of breeds of humped cattle found in India, East and West Africa, and Southeast Asia; right photo) cattle are the main hosts for CBPP. European breeds seem to be more susceptible than African breeds, and animals less than three years old are also more susceptible. Bison and yak have been infected in zoos, and infections have been reported in water buffalo. Wild bovids and camels are resistant. Photos courtesy of [www.carmenaquarterhorses.com](http://www.carmenaquarterhorses.com). *M. mycoides mycoides* small-colony type (SC) survives well only in vivo and is quickly inactivated when exposed to normal external environmental conditions. The organism does not survive in meat or meat products and does not survive outside the animal in nature for more than a few days.

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**Importance**



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**History**

- 1693: First reported case of CBPP
  - Germany; spread all over Europe
  - Enters U.S. with a dairy cow from England
- 1884: CBPP widespread in U.S.
  - Federal government establishes Bureau of Animal Industry to combat CBPP
- 1887: Quarantine and slaughter begin
- 1893: CBPP eradicated from U.S.

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The first reported case of CBPP was in 1693 in Germany. The disease then spread from Germany all over Europe, and eventually made its way into the U.S. via a dairy cow coming from England. By 1884, CBPP was so widespread and devastating that the Federal Government established the Bureau of Animal Industry (the forerunner of the USDA's APHIS, Animal and Plant Health Inspection Service) in attempt to rid the country of the disease. The first intensive campaign to control an animal disease by quarantine and slaughter began in 1887 with CBPP, and the disease was successfully eradicated from the U.S. in 1893.

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**Economic Impact**


- Countries with high incidence of CBPP
  - Zambia, Tanzania, Botswana
  - Already desperate economic situation
  - High economic, social impact
- Rapid spread of disease
  - Vaccination programs reduced
  - Drought conditions
    - Increased movement of animals
- Threatened social well-being, survival

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CBPP is classified by OIE as a List A disease, meaning that it spreads rapidly and can cross international borders. In countries which still have a high incidence of CBPP, such as Zambia, Tanzania and Botswana, the social and economic impact of the disease is substantial. With the difficult economic situation these countries already face, vaccination programs for CBPP have been reduced. In addition, drought conditions have led to the increased movement of animals, resulting in rapid spread of the disease throughout Africa. Depending on the country, farmers may not be compensated for their lost livestock, which threatens not only their livelihood but also their social well-being (Zambia), and even their survival (Botswana).


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**Epidemiology**



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**Geographic Distribution**



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Contagious bovine pleuropneumonia is endemic in Africa (shown in blue), and has a very high incidence in Zambia, Tanzania, and Botswana (red). It is less prevalent in Spain, Portugal, Italy, the Middle East, India, and China (yellow), and has been eradicated from the Western hemisphere, the UK and Australia (green).

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**Morbidity/Mortality**

- Morbidity
  - Increases with close confinement
  - Can reach 100% in susceptible herds
- Mortality
  - Ranges from 10-70%
  - Affected by secondary factors
    - Nutrition, parasitism
- 25% of recovered animals may become CBPP carriers

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Morbidity and mortality rates vary greatly for CBPP. Breed susceptibility, general health and management systems all influence the severity of infection. Morbidity increases with close confinement, and can reach 100% in susceptible herds. Mortality ranges from 10-70% and can be affected by secondary factors in overall health, such as nutrition and parasitism. Of recovered animals, as many as 25% may become carriers of CBPP.

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**Transmission**

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**Animal Transmission**

- Most common cause of outbreaks:
  - Introduction of carrier animal to susceptible herd
- Inhalation of infected drops of coughing animal
  - Close contact necessary
- Organism present in saliva, urine, fetal membranes, uterine discharges
- Humans are not susceptible

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Introduction of a carrier animal to a susceptible herd is the most common cause of outbreaks. Close contact is necessary for transmission, which occurs primarily through the inhalation of infected droplets from a coughing animal. The organism is also present in saliva, urine, fetal membranes, and uterine discharges. Transplacental infection has been known to occur. Humans are not susceptible to CBPP infection.

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**Animals and CBPP**

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**Clinical Signs:  
Acute Infections**

- Incubation period: 10 days to 6 months
- First signs
  - Lethargy, anorexia, fever, cough
  - Changes in posture
- Later signs
  - Thoracic pain, reluctance to move
  - Elbow abduction, moaning during expiration
  - Increased respiratory rate
    - Up to 55 breaths per minute


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The incubation period is highly variable, ranging from 10 days to six months, depending primarily on the susceptibility of the animal. In adult animals, lethargy, anorexia, fever (up to 107°F), and a drop in milk production are the first signs of CBPP; these are followed by a cough which becomes moist if the animal is forced to move quickly. The animal may also exhibit a change in posture, with the front legs placed far apart, the elbows turned out and the neck forward. The signs progress to include thoracic pain, dyspnea, an increased respiratory rate (up to 55 respirations per minute), moaning during expiration, reluctance to move, and elbow abduction.

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**Clinical Signs:  
Acute Infections**

- Neck outstretched
- Coughing
- Posture
  - Neck forward
  - Legs apart
  - Elbows turned out



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A common clinical finding in an animal infected with CBPP is the neck outstretched when the animal is coughing (top photo). When the animal is standing, the usual posture is with the neck forward, the legs placed far apart, and the elbows turned out (bottom photo). Photos courtesy of [www.fao.org](http://www.fao.org).

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**Clinical Signs**

- Chronic infections
  - Less obvious signs of pneumonia; coughing with exercise; emaciation; recurrent mild fever
  - Appear to recover after several weeks
- Congenitally infected calves
  - Polyarthritis
  - May not show signs of pneumonia
- Subclinical cases can be carriers


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Animals with chronic infections have less obvious signs of pneumonia, but may cough with exercise. These animals are often thin and may have a recurrent mild fever, and can appear to recover after several weeks. Infected calves commonly have polyarthritis with or without pneumonia. Joints may be warm and swollen and extremely painful. Subclinical cases occur and may be important as carriers.

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**Clinical Signs:  
Chronic Infections**

• Emaciation      • Depression



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Animals chronically infected with CBPP are often very thin and depressed, as shown above. Photo courtesy of APHIS-USDA at [www.aphis.usda.gov](http://www.aphis.usda.gov)

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**Post Mortem Lesions**

- Lung
  - Thickening, inflammation of lung tissue
  - Extensive fibrin accumulation, fibrosis
  - “Marbling”
- Thoracic cavity
  - Up to 10 L straw-colored fluid present
- Encapsulated sequestra
  - May become necrotic
- Joints enlarged
  - Organism survives, animal becomes carrier

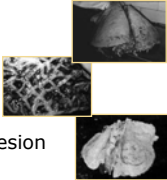
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The post mortem lesions of CBPP include thickening and inflammation of lung tissues with extensive fibrin accumulation. Large amounts of straw-colored fluid (up to 10L) may be present in the thoracic cavity. A characteristic “marbled” appearance of the affected lungs is caused by the presence of both acute and chronic lesions in the interlobular septa. Edema progresses to fibrin and then fibrosis. Encapsulated sequestra containing necrotic tissue can be found even in recovered animals. The organism can survive for many months within these sequestra, and the animal may become a carrier. The joints may also be enlarged due to proliferation of connective tissue.

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**Post Mortem Lesions: Lungs**

- Lung distension
- Marbling
- Large unilateral lesion



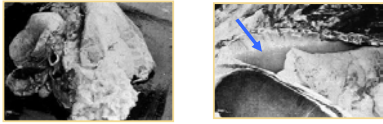
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The top photo shows two distended lungs; the left lung is distended with air, and the right lung has a large consolidated area in the diaphragmatic lobe and fibrin over the surface of the lung. The middle photo shows the characteristic “marbling” appearance: the white areas are interlobular septa thickened by connective tissue. In the bottom photo, a large sequestrum, in which the organism may persist and make the animal a carrier, is present only in the left lung; unilateral lesions are common with CBPP. Photos courtesy of USDA-APHIS at [www.aphis.usda.gov](http://www.aphis.usda.gov).

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**Post Mortem Lesions: Thoracic Cavity**

- Fibrinous mass
- Fluid in thoracic cavity



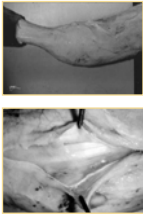
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Fibrinous masses in the thoracic cavity (left photo) are common post mortem findings in animals infected with CBPP, and there can be up to 10L of straw-colored fluid present in the thoracic cavity (right photo). Photos courtesy of USDA-APHIS at [www.aphis.usda.gov](http://www.aphis.usda.gov).

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**Post Mortem Lesions: Joints**

- Proliferation of connective tissue
- Tendosynovitis and arthritis



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The joint in the top photo is enlarged due to a proliferation of connective tissue, a common post mortem finding in animals infected with CBPP. The bottom photo shows a joint which is enlarged due to tendosynovitis (inflammation of the tendon and its sheath) and arthritis caused by CBPP infection. Photos courtesy of APHIS-USDA at [www.aphis.usda.gov](http://www.aphis.usda.gov).

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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

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Before collecting or sending any samples from animals with a suspected foreign animal disease, 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.

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**Diagnosis: Clinical and Differential**

- Clinical
  - Unilateral pneumonia
  - Polyarthritis in calves
  - Post mortem lesions helpful
- Differentials
  - East Coast fever
  - Bovine pasteurellosis
  - Bronchopneumonia

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Since there can be many causes of severe pneumonia in cattle, contagious bovine pleuropneumonia is difficult to diagnose based on clinical signs alone. Animals with CBPP frequently present with unilateral pneumonia, and in a herd with signs of pneumonia in adults and polyarthritis in calves, CBPP should be considered. Post mortem lesions are often helpful in diagnosis. The differential diagnoses include East Coast fever, bovine pasteurellosis, and bronchopneumonia resulting from mixed infections. Bovine pasteurellosis generally spreads more rapidly through a herd than CBPP, which can aid in the diagnosis. Chronic infections should be differentiated from hydatid cyst, actinobacillosis, tuberculosis, and bovine farcy.

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**Diagnosis: Laboratory**

- Metabolic and growth inhibition tests
- PCR
- Serology
  - Complement fixation
    - Used only for herd diagnosis, not individual
    - Useful with subclinical cases
  - Competitive ELISA
  - Hemagglutination
    - Active herd outbreaks

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*Mycoplasma mycoides mycoides* is isolated and identified by metabolic and growth inhibition tests and polymerase chain reaction (PCR). Serological tests include complement fixation (used only for herds, not for individual diagnosis; useful with subclinical cases), competitive ELISA and hemagglutination. An agglutination test is available for use in active outbreaks at the herd level.

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**Treatment**

- Recommended only in endemic areas
  - Elimination of organism may be impossible
    - Carriers may develop
  - Antibiotics generally ineffective
    - Can result in extensive tissue damage
    - Sequestration of organism
- Recommended action in outbreak
  - Slaughter and necropsy of a suspect animal

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Treatment is recommended only in endemic areas because elimination of the organism may not be possible, and carriers may develop. Antibiotic treatment is generally not effective as it can result in extensive tissue damage and sequestration of the organism, although tylosin has been reported to be moderately effective. As soon as an outbreak is suspected, slaughter and necropsy of a suspect animal is advisable.

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**CBPP in Humans**

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Humans are not susceptible to contagious bovine pleuropneumonia infection.

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**Prevention and Control**

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**Recommended Actions**

- Notification of Authorities
  - Federal:
    - Area Veterinarian in Charge (AVIC)
    - [www.aphis.usda.gov/vs/area\\_offices.htm](http://www.aphis.usda.gov/vs/area_offices.htm)
  - State veterinarian
    - [www.aphis.usda.gov/vs/sregs/official.htm](http://www.aphis.usda.gov/vs/sregs/official.htm)
- Quarantine



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If you suspect a case or outbreak of CBPP, contact your state and/or federal veterinarian immediately and establish a quarantine of the premise.

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**Quarantine and Disinfection**

- Quarantine
  - Exposed animals
- Test and slaughter
  - Infected animals
- Disinfection
  - Sodium hypochlorite
  - (3%)


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Quarantine of exposed and infected animals is recommended along with restricted movement, testing and slaughter of infected animals (top photo). Although *M. mycoides mycoides* may survive in the environment for a few days and survives well with freezing, it will not survive in meat or meat products and is inactivated by common disinfectants. Sodium hypochlorite can be used at a 3% solution, and is prepared by adding 3 gallons bleach to 2 gallons water. Bottom photo shows a typical disinfectant. Top photo courtesy of Katie Steneroden, ISU.

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**Vaccination**

- T1/44 strain
  - Eradication
  - Limit of disease spread
  - May not be possible due to economic constraints



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Immunization with attenuated vaccine (T1/44 strain) is helpful in disease eradication. In areas where cattle cannot be confined, the spread of infection can be curbed by vaccination. However, many of the countries in which CBPP is a serious problem have desperate economic situations, and vaccination may not be possible. We all need to do our part to keep our animals healthy and free of foreign animal diseases such as contagious bovine pleuropneumonia.

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**Additional Resources**


- World Organization for Animal Health (OIE) website
  - [www.oie.int](http://www.oie.int)
- Food and Agriculture Organization of the United Nations (FAO) website
  - [www.fao.org](http://www.fao.org)
- USDA-APHIS website
  - [www.aphis.usda.gov](http://www.aphis.usda.gov)

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**Acknowledgments**

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