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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

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. [Photo: Cow. Source: Wikimedia Commons]

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THE ORGANISM

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Contagious Bovine Pleuropneumonia (CBPP)

- *Mycoplasma mycoides* subsp. *mycoides*
  - Small colony type
  - Quickly inactivated in environment
  - Does not survive in meat or meat products
- African and European lineages

Mycoplasma mycoides subsp. *mycoides* small-colony type (SC type) bacteria is the causative agent of contagious bovine pleuropneumonia (CBPP). (*M. mycoides* subsp. *mycoides* large-colony type is the causative agent of contagious caprine pleuropneumonia and does not affect cattle). *M. mycoides* subsp. *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, nor does it survive outside the animal for more than a few days in nature. [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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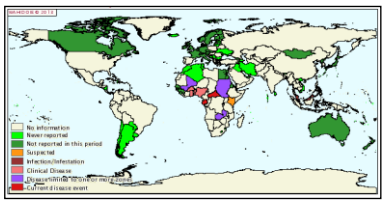
IMPORTANCE

Slide 6	**History** • 1693: First reported case of CBPP – Germany; spread all over Europe – Enters U.S. - dairy cow from England • 1884: CBPP widespread in U.S. – Federal government establishes Bureau of Animal Industry to combat CBPP • 1887: Quarantine, slaughter begin • 1893: CBPP eradicated from U.S.	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 an 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.
Slide 7	**Economic Impact** • Countries with high incidence of CBPP – Zambia, Tanzania, Botswana – High economic, social impact • Rapid spread of disease – Vaccination programs reduced – Drought conditions lead to increased animal movement • Threatened social well-being, survival	CBPP 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).
Slide 8	**EPIDEMIOLOGY**	
Slide 9	**Geographic Distribution** 	As of 2010, CBPP is endemic only in Africa. [Photo: This map shows the distribution of CBPP cases reported to the OIE between January through June 2013; light green indicates disease never reported, dark green indicates disease not reported in this period, orange indicates suspected disease, pink indicates clinical disease present, purple indicates disease limited to one or more zones, and red indicates a current disease event. Source: OIE World Animal Health Information Database (WAHID) at www.oie.int/wahis_2/public/wahid.php/Diseaseinformation/Diseasedistributionmap]
Slide 10	**Morbidity/Mortality** • Morbidity – Increases with close confinement – Can reach 100% in susceptible herds • Mortality – Ranges from 30 to 80% – Affected by secondary factors • 25% of recovered animals may become CBPP carriers	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; European breeds seem to be more susceptible than indigenous African breeds. Mortality ranges from 30 to 80% in Africa and can be affected by secondary factors in overall health, such as nutrition and parasitism. In Europe, recent outbreaks resulted in only mild disease and mortality rates were low. Of recovered animals, as many as 25% may become carriers of CBPP.

Slide 11	**TRANSMISSION**	
Slide 12	Animal Transmission • Introduction of carrier animal – Most common cause of outbreaks • Aerosol (close contact) • Direct contact – Saliva, urine, fetal membranes, uterine discharges – Transplacental • Humans are not susceptible	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.
Slide 13	**ANIMALS AND CBPP**	
Slide 14	Species Affected • Cattle • Asian buffalo • Captive bison • Yak • Humans are not susceptible  Center for Food Security and Public Health, Iowa State University, 2011	Cattle, both *Bos taurus* and *Bos indicus*, are the main hosts for *M. mycoides* SC (bovine). Infections have also been reported in Asian buffalo (*Bubalus bubalis*), captive bison (*Bison bison*) and yak (*Poephagus grunnien*, formerly *Bos grunnien*). Sheep can be infected experimentally with a bovine strain of *M. mycoides* SC, as well as with ovine strains. Wildlife does not appear to be important in the epidemiology of CBPP. Wild bovids and camels seem to be resistant, and, so far, do not appear to be important in the transmission of CBPP. Humans are not susceptible to CBPP infection. [Photo: (Top) Cattle. Source: Scott Bauer/USDA ARS; (Middle) Asian buffalo (domestic water buffalo). Source: Wikimedia Commons; (Bottom) Bison. Source: J Schmidt/National Park Service]
Slide 15	Clinical Signs: Acute Infection • Incubation period: 21 to 180 days • Initial signs – Lethargy, anorexia, fever, cough – Extended head/neck • Later signs – Thoracic pain, reluctance to move – Elbow abduction, moaning during expiration – Increased respiratory rate	The incubation period is highly variable and can be up as long as 21 to 180 days 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 stretched forward. These signs progress to include thoracic pain, dyspnea, an increased respiratory rate (up to 55 respirations per minute), moaning during expiration, and reluctance to move.

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Clinical Signs: Acute Infection

- Extended head/neck
- Coughing
- Unusual posture
  - Neck forward
  - Legs far apart
  - Elbows turned out

A common clinical finding in an animal infected with CBPP is the neck outstretched when the animal is coughing. When the animal is standing, the usual posture is with the neck forward, the legs placed far apart, and the elbows turned out.

(Photo: This cow is standing with its head and neck extended and legs placed widely apart, signs of difficulty breathing. Source: Botswana Department of Animal Health and Production via Food and Agriculture Organization (FAO) "Recognizing Contagious Bovine Pleuropneumonia" at ftp://ftp.fao.org/DOCREP/FAO/005/y4142e/y4142e00.pdf)

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Clinical Signs: Chronic Infection

- Less obvious signs of pneumonia
  - Coughing with exercise
  - Emaciation
  - Recurrent mild fever
  - Appear to recover after several weeks
- Calves
  - Polyarthritis +/- pneumonia
- Subclinical cases can be carriers

Animals with chronic infections have less obvious signs of pneumonia, but may cough with exercise. These animals are often thin, 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, swollen and extremely painful. Subclinical cases occur and may be important as carriers.

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Clinical Signs: Chronic Infection

Emaciation, depression

Animals chronically infected with CBPP are often very thin and depressed, as shown above.

(Photo: Emaciated cow. Source: www.fao.org. "Emergency prevention system for transboundary animal and plant pests and diseases: The livestock diseases component" available at http://www.fao.org/docrep/v8180t/v8180T0v.htm)

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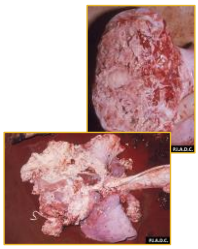
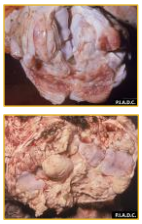
Post Mortem Lesions

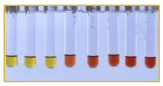
- Lung
  - Thickening
  - Extensive fibrin and fibrosis
  - Marbling
- Thoracic cavity
  - Straw-colored fluid
- Encapsulated
  - May be necrotic
- Joints enlarged



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 accumulation 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.

(Photo: (Top) Bovine, lungs. Most of the pleural surface is covered by abundant fibrin and fibrous tissue. (Bottom) Bovine, lung. Most of the parenchyma is dull, tan, and contains multiple cavities (necrotic); since it is partially surrounded by a fibrous capsule, this necrotic zone is termed a sequestrum. In the viable tissue above and below the sequestrum, the interlobular septa are markedly thickened by fibrous tissue. Source: USDA Plum Island Animal Center/CFSPH)

Slide 20	**Post Mortem Lesions: Thoracic Cavity** Fibrin Fluid in thoracic cavity 	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). (Photo: Bovine, pleural cavity. Large sheets of fibrin cover the costal and diaphragmatic pleura, and form pockets containing straw-colored fluid. Source: USDA Plum Island Animal Center/CFSPH)
Slide 21	**Post Mortem Lesions: Joints** • Proliferation of connective tissue • Tendosynovitis and arthritis • Fibrin in synovial space • Articular cartilage erosion 	Enlargement of the joints due to a proliferation of connective tissue, is a common post mortem finding in animals infected with CBPP. Enlargement of the joint due to tendosynovitis (inflammation of the tendon and its sheath) and arthritis also occurs. (Photo: (Top) Bovine, carpus. The joint capsule and adjacent extensor tendon sheath are markedly thickened and contain excessive fluid. The tendon sheath synovium is congested and covered by small flecks of fibrin. (Bottom) Bovine, carpus. There is abundant fibrin within the synovial space and on the synovium, and articular cartilages contain a few small erosions. Source: USDA Plum Island Animal Center/CFSPH)
Slide 22	**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 should be contacted. Samples should only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease.
Slide 23	**Diagnosis: Clinical** • Difficult to distinguish from other respiratory diseases in cattle • Clinical indicators – Unilateral pneumonia – Polyarthritis in calves – Post mortem lesions 	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. (Photo: Cows grazing. Source: Scott Bauer/U.S. Department of Agriculture)

Slide 24	**Differential Diagnosis** • Bovine pasteurellosis (mannheimiosis) • Hemorrhagic septicemia • Theileriosis (East Coast fever) • Bovine ephemeral fever • Rinderpest • Traumatic pericarditis	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. In addition, hemorrhagic septicemia, bovine ephemeral fever, rinderpest, and traumatic pericarditis should be considered as differentials. Chronic infections should be differentiated from hydatid cysts, actinobacillosis, tuberculosis, and bovine farcy.
Slide 25	**Diagnosis: Laboratory** • Culture • Immunological tests • PCR • Serology – Complement fixation – Competitive ELISA – Immunoblot – Latex agglutination 	*Mycoplasma mycoides* subsp. *mycoides* can be directly identified by culture, immunological tests, and the polymerase chain reaction (PCR). Serological tests include complement fixation (used only for herds, not for individual diagnosis; useful with subclinical cases), competitive ELISA, and immunoblot. A latex agglutination test has also been developed. False positive reactions may be seen in serologic tests due to other mycoplasmas. (Photo: *Mycoplasma* broth tubes. Source: CDC Public Health Image Library)
Slide 26	**Treatment** • Recommended only in endemic areas – Elimination of organism may be impossible – Carriers may develop – Antibiotics generally ineffective • Recommended action in outbreak – Slaughter and necropsy suspect animals	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.
Slide 27	**CBPP IN HUMANS** Humans are not susceptible.	Humans are not susceptible to contagious bovine pleuropneumonia infection.
Slide 28	**PREVENTION AND CONTROL**	

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Recommended Actions

- IMMEDIATELY notify authorities
- Federal
  - Area Veterinarian in Charge (AVIC)
    www.aphis.usda.gov/vs/nahss/swine/csf/CSF_PM_2007_AppendC_Directory.pdf
- State
  - State veterinarian
    www.usaha.org/StateAnimalHealthOfficials.pdf
- Quarantine

If you suspect a case or outbreak of CBPP, contact your state and/or federal veterinarian immediately and quarantine the premises. If CBPP is detected in a non-endemic country, a strict quarantine zone should be established.

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Quarantine and Disinfection

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

Quarantine of exposed and infected animals is recommended along with restricted movement, testing, and slaughter of infected animals. Although *M. mycoides* subsp. *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. (Photos: (Top) Farm gate with quarantine signage. Source: Katie Steneroden, Iowa State Univeristy/CFSPH; (Bottom) Disinfection equipment. Source: Danelle Bickett-Weddle, Iowa State University/CFSPH)

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Vaccination

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

Immunization with an 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.

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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")
  - www.usaha.org/Portals/6/Publications/FAD.pdf

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