Slide 1

Glanders

Farcy
Equinia
Malleus
Droes

Slide 2

Overview

- Organism
- History
- Epidemiology
- Transmission
- Disease in Humans
- Disease in Animals
- Prevention and Control
- Actions to Take

In today's presentation we will cover information regarding the organism that causes glanders and its epidemiology. We will also talk about the history of the disease, how it is transmitted, species that it affects, and clinical and necropsy signs observed. Finally, we will address prevention and control measures for glanders, as well as actions to take if glanders is suspected.

[Photo: Horse. Source: www.public-domain-images.com]

Slide 3

THE ORGANISM

Slide 4

The Organism

- *Burkholderia mallei*
  - Gram negative bacillus
  - Exists primarily in infected host
  - Prolonged survival in favorable environments
  - Inactivated by heat and sunlight
- Related to *Burkholderia pseudomallei*
  - Cause of meliodosis

Glanders is caused by the bacteria *Burkholderia mallei.* This organism has gone through several name changes, including *Pseudomonas mallei*, *Malleomyces mallei*, and *Actinomyces mallei*. It is a Gram negative bacillus and predominantly exists in infected hosts, but may remain viable for several months in warm moist environments. Although this organism is inactivated by heat and sunlight, its survival is prolonged in wet or humid environments. *B. mallei* remains viable in room temperature water for up to a month, and may be viable for more than a year in favorable environments. The organism is closely related to *Burkholderia pseudomallei*, the causative agent of melioidosis; the two are serologically indistinguishable in some cases. The genetic homology between the two organisms is great, and because of this, many consider them to be biotypes or isotypes of the same organism.

[Photo: Scanning electron micrograph of the bacillus shape of *Burkholderia*. Source: CDC Public Health Image Library]

Slide 5

HISTORY

Slide 6

History

- 3rd Century BC
  - Described by Aristotle
- 1664: Contagious nature recognized
- 1830: Zoonotic nature suspected
- 1891: Mallein test developed
- 1900: Control programs implemented

Center for Food Security and Public Health, Iowa State University, 2011

The first recorded description of glanders was in the third century by Aristotle. In 1664, glanders was recognized as a contagious organism, and in 1830 its zoonotic potential was suspected. In the late 1800s, the Mallein test was developed for the diagnosis of glanders. At the turn of the century, the U.S., Canada, and Great Britain all implemented glanders-control programs.

Slide 7

History

- World War I
  - Suspected use as biological agent to infect Russian horses and mules
  - Large number of human cases in Russia during and after WWI

Center for Food Security and Public Health, Iowa State University, 2011

During World War I, glanders was believed to have been spread deliberately to infect large numbers of Russian horses and mules on the Eastern Front. This affected the troops and supply convoys, as well as artillery movement because of their dependence on horses and mules. Human cases of glanders also increased in Russia during and after WWI.

[Photo: Allied cavalries, such as this Belgian convoy, may have been the target of glanders attacks in World War I. Source: Nova Online, Iowa Public Television.]

Slide 8

History

- World War II
  - Japanese infected horses, civilians, and POWs
  - U.S. and Russia investigated use as biological weapon

Center for Food Security and Public Health, Iowa State University, 2011

It is widely held that the Japanese deliberately infected horses, civilians, and prisoners of war with glanders during World War II. The United States studied glanders as a possible biological weapon in 1943-44 but did not weaponize it. The former Soviet Union is also believed to have been interested in *B. mallei* as a potential biological weapon agent after World War II.

(Photos: Soldiers with their horses. Source: (Bottom right) www.civilwarhome.com/images/cavalry.jpg; www.continet.com/ppsh/cavalry.jpg; www.firstworldwar.com/diaries/ graphics/horsesdrinking.jpg)

Slide 9

History

- 1934
  - Eliminated from animals in the U.S.
- 1945
  - Six lab acquired cases at Camp Detrick
- 2000
  - Human case in laboratory worker at USAMRIID

Center for Food Security and Public Health, Iowa State University, 2011

Glanders was eliminated from U.S. domesticated animals in the 1930s. Six unrelated cases of glanders occurred in 1945 among laboratory workers on a biologic-weapons program at Camp Detrick, Maryland. One recent human case of glanders in a laboratory worker occurred in 2000. A microbiologist at USAMRIID (U.S. Army Medical Research Institute of Infectious Disease) became febrile and presented with a mass in his left axilla. Despite the fact he received aggressive antibiotic therapy, he developed multiple splenic and hepatic masses and eventually respiratory distress. With continued antibiotic treatment he eventually recovered. A diagnosis of glanders

was not confirmed until 2 months later, though a tentative diagnosis was suspected due to his work history. This was the first human case reported in the U.S. since 1945. Despite the efficiency of spread in a laboratory setting, glanders has only been a sporadic disease in humans. No epidemics of human disease have been reported.

[Photo: United States Army Medical Research Institute of Infectious Diseases (USAMRIID) building in Fort Detrick, Maryland. Source: Wikimedia Commons]

Slide 10

TRANSMISSION

Slide 11

Transmission: Humans

- Direct contact with infected animals
  - Abraded skin
  - Mucous membranes
- Fomites
- Inhalation
- Ingestion
- Person-to-person (rare)

Center for Food Security and Public Health, Iowa State University, 2011

Glanders is transmitted to humans by direct contact with infected animals, contaminated fomites, tissues, or bacterial cultures. The bacteria enters the body through abraded or lacerated skin and through mucosal surfaces of the eyes, nose, and mouth. Inhalation or ingestion of infectious material can also occur. Cases of human-to-human transmission have also been reported. Aerosols may be the major route of infection in a bioterrorist attack.

Slide 12

Transmission: Animals

- Ingestion
  - Contaminated food and water
  - Skin exudates, respiratory secretions
- Inhalation
- Direct contact
- Fomites
  - Grooming tools
  - Harnesses

Center for Food Security and Public Health, Iowa State University, 2011

Glanders is introduced into horse populations by diseased or latently infected animals. Ingestion of the organism is the major route of infection. Experimental evidence suggests that inhalation of the organism is less likely to result in typical cases of the disease. Acquiring the disease through skin or mucous membranes is possible but regarded as of minor importance in the natural spread of the disease. Close contact between animals alone does not usually result in transmission, but transmission is facilitated if animals share feeding or watering facilities. *B. mallei* is readily spread on fomites, including harnesses, grooming tools, and food and water troughs. Carnivores usually become infected when they eat contaminated meat.

[Photo: two horses sharing water. Source: Katie Lawless/nationalgeographic.com]

Slide 13

EPIDEMIOLOGY

Slide 14

Epidemiology

- Endemic
  - Parts of Africa, the Middle East, Asia, and South America
- Possible occurrence
  - Balkan states, former Soviet republics
- Sporadic cases
  - Central America
- Once widespread, has been eradicated from many countries

Center for Food Security and Public Health, Iowa State University, 2011

Glanders is endemic in parts of Asia, Africa, the Middle East, South America and possibly the Balkan states, former Soviet republics, and Mexico. Sporadic cases occur in Central America. Between 1998 and 2007, cases were reported from Brazil, Turkey, the former U.S.S.R., Eritrea, Ethiopia, Iran, Iraq, United Arab Emirates, and Mongolia. This disease may also exist in Pakistan. The geographic distribution of *B. mallei* is difficult to determine precisely as cross reactions with serological tests for melioidosis (*Burkholderia pseudomallei*) most likely confound the true estimates of worldwide distribution. Although glanders was once widespread throughout the world, it has been eradicated from many countries by test and slaughter programs. In countries that have eradicated glanders, cases may occur in researchers who work with this agent.

Slide 15

Host Range

- Affects solipeds
  - Donkeys
    - Acute form
  - Horses
    - Chronic form
- Carnivores, humans, and goats susceptible
- Swine and cattle resistant

Center for Food Security and Public Health, Iowa State University, 2011

Glanders is primarily a disease of solipeds – particularly horses, donkeys, and mules. Donkeys have been regarded as most likely to experience the acute form of the disease, while a more chronic form of the disease is common in horses. Sources disagree whether mules are more likely to develop acute or chronic disease. Carnivores are susceptible if they consume infected meat; felids appear to be more susceptible than canids. Several laboratory animals are susceptible to infection, including hamsters and guinea pigs. Humans also are susceptible to infection. Swine and cattle are resistant, but goats and sheep can be infected. Most domesticated animals other than cattle, pigs, and rats can be infected experimentally. Wildlife species, including bears, wolves, field mice, rabbits, and voles, have also been infected. Hamsters and guinea pigs are the most susceptible rodents. Mice are resistant to disease unless the dose of organisms is high.

[Photo: (Top) Horses. Source: U.S. Department of Agriculture. (Bottom): Donkey. Source: Wikimedia Commons]

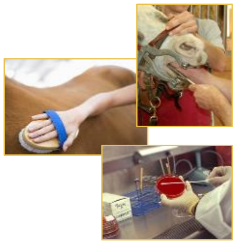
Slide 16

DISEASE IN HUMANS

Slide 17

Who Is At Risk?

- Veterinarians
- Grooms
- Horsemen
- Butchers
- Lab workers



Center for Food Security and Public Health, Iowa State University, 2011

Humans that have occupational exposure are at the highest risk for infection. This includes: workers in laboratory settings, veterinarians, grooms, horsemen, butchers, and any other people who work closely with horses.

[Photo: (Top) Veterinarian floating a horses teeth. Source: horsebackmagazine.com; (Middle) Grooming horse. Source: Michigan State University Extension; (Bottom) Laboratorian swabbing a petri dish. Source: www.labtestsonline.com]

Slide 18

Disease in Humans

- Four forms of infection
  - Localized cutaneous
  - Pulmonary
  - Septicemic
  - Chronic form
- Generalized symptoms
  - Fever, malaise, muscle ache, chest pain
- Case-fatality rate: 95% (untreated)

Center for Food Security and Public Health, Iowa State University, 2011

Four forms of glanders are seen in humans: the local cutaneous form, pulmonary form, septicemic form, and the chronic form. Generalized symptoms of glanders include fever, muscle aches, chest pain, muscle tightness, and headache. Occasionally tearing of the eyes, photophobia, and diarrhea are seen. Without treatment there is a 95% fatality rate with all forms of glanders.

Slide 19

Clinical Signs: Cutaneous

- Incubation period: 1 to 5 days
  - Erythema and ulceration of skin
  - Lymphadenopathy
  - Nodules
    - Along lymph vessels
    - Highly infectious exudate
- Case fatality rate: 20% when treated

Center for Food Security and Public Health, Iowa State University, 2011

Localized infections are characterized by nodules, abscesses, and ulcers in the mucous membranes, skin, lymphatic vessels, and/or subcutaneous tissues at the site of inoculation. The nodules are white or gray and firm with a caseous or calcified center. They are surrounded by areas of inflammation. When the mucous membranes are involved, a mucopurulent, sometimes blood–tinged discharge may be seen. These lesions are accompanied by fever, sweats, malaise, and swelling of the regional lymph nodes. Abscesses often develop in the lymph nodes, and they may drain. Mucosal or skin infections may disseminate after one to four weeks; symptoms of disseminated infections include a papular or pustular rash and abscesses in the internal organs. These abscesses are often found in the liver, spleen, and lungs, but any tissue, including the subcutaneous tissues and muscles, can be affected. Disseminated infections often progress to septicemia. The mortality rate for localized disease is 20% when treated; untreated cases often progress to other forms.

Slide 20

Clinical Signs: Pulmonary

- Incubation period: 10 to 14 days
  - Inhalation of aerosolized bacteria
  - Hematogenous spread to lungs
  - Pneumonia, pulmonary abscesses, pleural effusion
- Case-fatality rate
  - 90 to 95% if untreated
  - 40% if treated

Center for Food Security and Public Health, Iowa State University, 2011

The pulmonary form occurs after inhalation of *B. mallei* or by hematogenous spread from other forms. It is characterized by pulmonary abscesses, pleural effusion, and pneumonia. The onset is usually acute. The symptoms include fever, sweats, and coughing and chest pain, progressing to dyspnea. Ulcers and nodules, accompanied by a mucopurulent discharge, can occur in the nose. Skin abscesses may also be seen; these abscesses can develop up to several months after the organisms were inhaled. Untreated pulmonary disease often develops into septicemia. The mortality rate in the pulmonary form is 90 to 95% if untreated, and 40% if treated.

Slide 21

Clinical Signs: Septicemia

- Incubation period: 1 to 5 days
  - Any site of infection can lead to sepsis
  - Fever, chills, myalgia, chest pain, rash
  - Tachycardia, jaundice, photophobia, lacrimation
- Case-fatality rate
  - ≥95% untreated; >50% treated
- Rapidly fatal

The incubation period of the septic form is 1 to 5 days. This form occurs when the bacteria enter the blood stream in large enough numbers. The septicemic form can occur independently or as a result of the pulmonary or cutaneous forms. It can also cause the pulmonary and/or cutaneous forms. With the septicemic form, fever, chills, myalgia, headache, and pleuritic chest pain develop acutely. Flushing, a pustular or papular rash, lymphadenopathy, cellulitis, cyanosis, jaundice, photophobia, diarrhea, and granulomatous or necrotizing lesions may be seen. Tachycardia and mild hepatomegaly or splenomegaly have also been reported. Multi-organ failure is common, and death often occurs 24 to 48 hours after the onset of symptoms. In the septicemic form, the case fatality rate is 95% or higher in untreated cases, and more than 50% when the infection is treated.

Slide 22

Clinical Signs: Chronic

- "Farcy"
  - Multiple abscesses
    - Muscles, joints, spleen, liver
  - Weight loss
  - Lymphadenopathy
- Case-fatality rate: 50% (treated)
- Relapses common
- Disease can last up to 25 years

The chronic form of glanders is known as "farcy". The chronic form is characterized by multiple abscesses, nodules, and ulcers in a variety of tissues, with periodic recrudescence and milder symptoms than acute disease. A wide variety of organs can be affected, including the skin/subcutaneous tissues, liver, spleen, gastrointestinal tract, respiratory tract, and skeletal muscles. Weight loss and lymphadenopathy are often seen. This form of the disease can last up to 25 years. There is a 50% case fatality rate even with treatment and relapses are common.

Slide 23

Differential Diagnosis

- Typhoid fever
- Tuberculosis
- Syphilis
- Erysipelas
- Lymphangitis
- Pyemia
- Yaws
- Melioidosis

Human glanders may be confused with a variety of other diseases, including typhoid fever, tuberculosis, syphilis, erysipelas, lymphangitis, pyemia, yaws, and melioidosis.

Slide 24

Diagnosis: Humans

- Culture and Gram stain
  - Sputum, urine, skin lesions, blood
  - Gram negative bacilli
  - Safety pin appearance
- Agglutination tests
  - May be positive after 7 to 10 days
  - High background titer in normal sera makes interpretation difficult

Glanders is diagnosed in the laboratory by isolating the bacteria. Culture and Gram stain of blood, sputum, urine, or skin lesions can be performed. Blood cultures, however, are generally not useful as they tend to remain negative until the patient is near death. Gram stain may reveal small Gram-negative bacilli, which stain irregularly with methylene blue and may have a safety pin appearance. Meat nutrient agar with the addition of 1 to 5% glucose may accelerate growth of bacteria. Agglutination tests may be positive after 7 to 10 days, but a high background titer found in normal sera makes interpretation difficult. In addition, serologic reactions to *B. mallei* cannot be differentiated from reactions to *B. pseudomallei.*

Slide 25

Diagnosis: Humans

- Complement fixation
  - More specific
  - Positive if titer is equal to or greater than 1:20
- Chest radiograph for the pulmonary form of disease
- PCR

Center for Food Security and Public Health, Iowa State University, 2011

Compliment fixation tests are more specific and are considered positive for glanders if the titer is equal to or greater than 1:20. A chest radiograph may demonstrate bilateral bronchopneumonia, miliary nodules, segmental or lobar infiltrates and cavitating lesions with the pulmonary form of the disease. Polymerase chain reaction (PCR) assays may be available in some laboratories. One recently published PCR assay can differentiate *B. mallei* from *B. pseudomallei*. Other genetic techniques to distinguish these two organisms include PCR-restriction fragment length polymorphism, pulse-field gel, electrophoresis, 16S rRNA sequencing, variable number tandem repeat polymorphism and multilocus sequencing. These specialized techniques mentioned may be available mainly in research laboratories.

Slide 26

Treatment

- Limited information on treatment
- Long term antibiotic treatment necessary (1 to 12 months)
- Multiple drug therapy
- Drain abscesses

Center for Food Security and Public Health, Iowa State University, 2011

Limited information exists regarding antibiotic treatment of glanders since the disease had largely disappeared by the time antibiotics became available. Long term treatment and multiple drugs may be necessary, up to 12 months for extrapulmonary suppurative disease. Few studies have been published on the antibiotic susceptibility of *B. mallei*, but some treatment recommendations are available. This organism is usually resistant to some classes of antibiotics. Abscesses may need to be drained.

Slide 27

DISEASE IN ANIMALS

Slide 28

Disease in Animals

- Forms of disease not clearly distinct
  - May occur simultaneously
  - Incubation period: 2 to 6 weeks is typical
- Nasal form
  - Fever, cough, dyspnea, thick nasal discharge, ulcers
  - Lymph node and vessel involvement
  - Death

Center for Food Security and Public Health, Iowa State University, 2011

The forms of disease in animals are not as clearly distinct as in humans and may occur simultaneously. In animals, glanders may appear immediately or become latent. The incubation period varies from a few days to many months; two to six weeks is typical. Experimental infections can result in clinical signs after three days. In equids, glanders is traditionally categorized into nasal, pulmonary, and cutaneous forms. The three forms can occur simultaneously in an animal. With the nasal form, deep ulcers and nodules occur inside the nasal passages resulting in a thick, purulent, yellowish discharge. This discharge may be unilateral or bilateral, and can become bloody. Nasal perforation is possible. The regional (submaxillary) lymph nodes become enlarged and indurated, and may suppurate and drain. Healed ulcers become star–shaped scars. Secondary skin infections, with nodules, ulcers, and abscesses may be seen.

[Photo: Nasal discharge in a horse with glanders. Source: Microbe Wiki]

Slide 29

Disease in Animals

Pulmonary Form	Cutaneous Form
–Nodules and abscesses in lungs	–Nodules and ulcers on skin
–Dyspnea	–Lymphadenopathy
–Coughing	–Swollen joints and edema of legs
–Fever	–Glanderous orchitis in males
–Progressive debilitation	

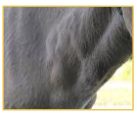
Center for Food Security and Public Health, Iowa State University, 2011

With the pulmonary form, nodules and abscesses develop in the lungs. Some infections are inapparent; others vary from mild dyspnea to severe respiratory disease. In more severe cases, the clinical signs include coughing, dyspnea, febrile episodes, and progressive debilitation. Diarrhea and polyuria may also be seen. Discharges from pulmonary abscesses can spread the infection to the upper respiratory tract. With the cutaneous form, the skin contains nodules that rupture and ulcerate, discharging an oily, purulent, yellow exudate. The regional lymphatics and lymph nodes become chronically enlarged; the lymphatics are filled with a purulent exudate. In addition, there may be swelling of the joints and painful edema of the legs. Glanderous orchitis is a common symptom in males.

Slide 30

Disease in Animals

- Acute Disease
  - –More common in donkeys
  - –Nasal and pulmonary signs
    - Coughing, dyspnea
    - Nodules and ulcers on nasal mucosa
    - Enlarged submaxillary lymph nodes
  - –Neurological signs possibly
  - –Death



Center for Food Security and Public Health, Iowa State University, 2011

Glanders can occur as an acute, chronic, or latent form. Acute disease is more likely to occur in donkeys, while chronic or latent disease is more common in horses. Nasal and pulmonary signs are usually seen in the acute form. The symptoms include a high fever, decreased appetite, coughing, progressive dyspnea, nasal discharge, and deep, rapidly spreading ulcers and nodules on the nasal mucosa. Bloody crusting may be seen on the nostrils, and there may be a purulent ocular discharge. The submaxillary lymph nodes are usually swollen and painful. Neurological signs have been reported in experimentally infected horses, possibly as the result of secondary bacterial infections from a compromised blood-brain barrier. Animals with the acute form of glanders usually die in a few days to a few weeks. [Photo: Nodules of lymphatic vessel tracts in the cervical region of an equid. Source: Brazilian Journal of Microbiology.]

Slide 31

Disease in Animals

- Chronic form
  - Coughing, malaise, fever, weight loss
  - Nasal discharge and ulcers, skin nodules
  - Lymph node and vessel involvement
  - Swelling of joints and leg edema
- Latent form
  - May be few symptoms
  - Nasal discharge
  - Glanderous orchitis common

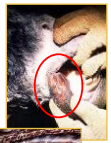
Center for Food Security and Public Health, Iowa State University, 2011

The chronic form develops insidiously and results in progressive debilitation. The symptoms may include coughing, malaise, dyspnea, an intermittent fever, enlargement of the lymph nodes, and a chronic nasal discharge with ulcers, nodules, and stellate scars on the nasal mucosa. The skin and lymphatics may also be involved. The chronic form is slowly progressive and is often fatal; however, affected animals may live for years before succumbing to the disease. In the latent form, there may be few symptoms other than a nasal discharge and occasional labored breathing. Lesions may be found only in the lungs.

Slide 32

Gross Lesions-Necropsy

- Ulcers, nodules, stellate scars in upper respiratory
- Pneumonia
- Firm rounded miliary nodules
- Swollen lymph nodes and vessels



Center for Food Security and Public Health, Iowa State University, 2011

At necropsy there may be ulcers, nodules, and stellate scars in the nasal cavity, trachea, pharynx, larynx, skin, and subcutaneous tissues. Catarrhal bronchopneumonia with enlarged bronchial lymph nodes may be present. The lungs, liver, spleen and kidneys may contain firm, rounded, encapsulated miliary gray nodules similar to tubercles. The lymphatic vessels may be swollen, the lymph nodes are typically enlarged and fibrotic and contain focal abscesses. In addition, necrosis may be noted in the internal organs and testes. The upper photo shows a granulomatous lesion in the lip of a donkey. Lower photo is an extensive pyogenic granulomatous pneumonia in a donkey. (Photos: (Top) A granulomatous lesion in the lip of a donkey. (Bottom) Extensive pyogenic granulomatous pneumonia in a donkey. Source: USAHA Foreign Animal Diseases (The Gray Book) at http://www.aphis.usda.gov/emergency_response/downloads/nahems/fad.pdf]

Slide 33

Differential Diagnosis

- Melioidosis
- Strangles
- Lymphangitis
- Other forms of pneumonia
- Gutteral pouch empyema
- Dermatophilosis
- Dermatomycoses

Signs of glanders must be distinguished from melioidosis, strangles, lymphangitis, ulcerative lymphangitis, and other forms of pneumonia. Purulent sinusitis, gutteral pouch empyema, and other causes of nasal catarrh should also be considered. Skin lesions may be similar to those of dermatophilosis or dermatomycoses, such as sporotrichosis.

Slide 34

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 35

Diagnosis: Animals

- Isolation of *Burkholderia mallei*
  - Blood, sputum, urine or skin lesions
- Mallein test
  - Intrapalpebral or conjunctival injection
  - Swelling 1 to 2 days later
- Serology
- Compliment fixation and ELISA
  - Most reliable in horses

Glanders can be diagnosed by bacteriologic isolation of *B. mallei* from skin lesions or blood samples. Inoculation into guinea pigs, the mallein test, and serology can also be used. With the mallein test, a positive reaction is indicated by eyelid swelling 1 to 2 days after intrapalpebral injection of a protein fraction of *B. mallei*, or by conjunctivitis after administration in eyedrops. This is similar to tuberculin testing. A variety of serologic tests are available, including complement fixation, ELISA, indirect hemagglutination, counter-immunoelectrophoresis and immunofluorescence. The most accurate and reliable tests in horses are complement fixation and ELISA. Agglutination and precipitin tests are unreliable for horses with chronic glanders and animals in poor condition. Serological tests cannot distinguish reactions to *B. mallei* from reactions to *B. pseudomallei*.

Slide 36

Treatment

- Antibiotics effective
  - Endemic areas
- Treatment controversial
  - Asymptomatic carriers may result

Antibiotics may be affective, but treatment is given only in endemic areas. Treatment is risky even in these regions, as infections can be spread to humans and other animals, and treated animals may become asymptomatic carriers.

[Photo: Horses in pasture. Source: Wikimedia Commons]

Slide 37

PREVENTION AND CONTROL

Slide 38

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 glanders infection is suspected, state or federal authorities should be notified immediately. Animals suspected with glanders should be isolated, and the farm should be quarantined until definitive diagnosis is determined.

Slide 39

Prevention: Humans

- Elimination of disease in animals
- Biosafety level 3 required in labs
- Protective clothing during exams and necropsy
  - Gloves and mask

In countries where glanders is endemic in animals, prevention of the disease in humans involves identification and elimination of the infection in animal populations. Within the health care setting, transmission can be prevented by using common blood and body fluid precautions. Biosafety level 3 containment practices are required for laboratory staff when working with glanders. Field veterinarians and veterinary pathologists must take strict precautions to prevent human infections by the cutaneous or respiratory route during clinical or post-mortem exams of suspected cases. Adequate protective clothing, including gloves and face masks, should be worn.

Slide 40

Prevention

- Horses
  - Early detection and quarantine with disinfection
  - Test and slaughter
- Reportable to state veterinarian
- Vaccine not available for humans or animals

Prevention in animal settings include early detection and quarantine procedures. Animals that test positive for glanders are euthanized except in endemic areas. In an outbreak, the premises should be quarantined, thoroughly cleaned, and disinfected. All contaminated bedding and food should be burned or buried, and equipment and other fomites should be disinfected. Carcasses should be burned or buried. Susceptible animals should, if possible, be kept away from contaminated premises for several months. In endemic areas, susceptible animals should be kept away from communal feeding and watering areas, since glanders is more common where animals congregate. Routine testing and euthanasia of positive animals can eradicate the disease. A vaccine is not available for humans or animals.

[Photo: Horses. Source: U.S. Department of Agriculture]

Slide 41

Glanders as a Biological Weapon

- History
- Very few organisms required to cause disease
- Easily produced
- Pulmonary form has high mortality
- Limited experience with disease can slow diagnosis and treatment

Glanders has several characteristics that make it a potential agent for biological warfare and terrorism. Very few *Burkholderia mallei* organisms are required to cause disease, and the organism is easily produced. In a single year in the 1980s, the Soviet Union produced more than 2,000 tons of dry agent of glanders. When the bacteria is inhaled as an aerosol, the disease can have a very high mortality rate. Additionally, diagnosis and treatment of glanders may be complicated by the lack of knowledge of its infection. Patients who recover do not develop a protective immunity, thus the agent could be reused.

Slide 42

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.aphis.usda.gov/emergency_response/downloads/nahems/fad.pdf

Slide 43

Acknowledgments

Development of this presentation was made possible through grants provided to the Center for Food Security and Public Health at Iowa State University, College of Veterinary Medicine from the Centers for Disease Control and Prevention, the U.S. Department of Agriculture, the Iowa Homeland Security and Emergency Management Division, and the Multi-State Partnership for Security in Agriculture.

Authors: *Jamie Snow, DVM, MPH; Katie Steneroden, DVM, MPH; Radford Davis, DVM, MPH, DACVPM*
Reviewers: *Katie Spaulding, BS; Jared Voge, MS; Kerry Leedom Larson, DVM, MPH, PhD*

Last reviewed: February 2011