## GLANDERS (Burkholderia mallei)

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<th>Animal Group(s) Affected</th>
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<td>Primarily equids, also a risk to exotic cats, humans, dogs, cats, sheep, goats, camels, bears, hamsters, mice, and guinea pigs</td>
<td>Injection/ ingestion/ inhalation of particles or direct contact between open skin or mucous membrane and infected tissue or secretions. Non-equid species often by ingestion of infected horse meat</td>
<td>Loss of stamina, dyspnea. Acute: coughing, high fever, nasal discharge and ulcers, epistaxis, fulminant septicemia. Chronic: cutaneous generalized lymphadenopathy, ulcerated skin nodules. Felids develop localized nodules on nasal mucosa and bloody nasal discharge within 1-2 weeks after consuming infected meat.</td>
<td>Acute septic death typically occurring in 4-7 days and up to 3-4 weeks after onset of illness.</td>
<td>Antibiotics may be used in endemic areas; euthanasia required in non-endemic areas.</td>
<td>Strict entry requirements from endemic areas to non-endemic areas. CFT test and PCR used for diagnosis. Reportable outside US in non-endemic areas to OIE and local vet authority. (In US to USDA – AVIC and State vet.) Mallein test – mallein purified protein derivative (PPD) available commercially.</td>
<td>Yes</td>
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**Susceptible animal groups:** Equids are primarily affected. Other animals such as dogs, exotic felids – both captive and free-ranging, sheep, goats, camels, wild cats, bears, hamsters, mice and guinea pigs are at risk.  

**Causative organism:** *Burkholderia mallei* (also previously designated *Pseudomonas mallei, Bacillus mallei, Pfeifferella mallei, Mycobacterium mallei, Loefflerella mallei, Malleomyces mallei, and Actinobacillus mallei*), has been identified as the causative agent. It is a Gram-negative, non-motile, non-spore forming, facultative intracellular bacillus.  

**Zoonotic potential:** Zoonotic transmission occurs through ingestion of contaminated meat, and injection, ingestion and inhalation of particles or direct contact between open skin or mucous membranes and infected tissue or secretions.  

**Distribution:** Re-emerging trans-boundary disease endemic in Middle East, Asia and South America and also seen Africa. A steady increase in outbreaks of disease in Middle East, Asia and South America has been reported although it has been eradicated from North America, Australia and Western Europe through surveillance and destruction of affected animals, and strict import restrictions.  

**Incubation period:** Natural infections require 4 days, usually within 6 days, to several months. Experimental
Infections can produce signs within 3 days.

**Clinical signs:** The organism is zoonotic and has four basic disease forms in both horses and humans: cutaneous, upper respiratory, pulmonary and septicemic.

**Cutaneous:** Acutely, it is more common in mules and donkeys, with death typically occurring in 4-7 days to 3-4 weeks after onset of illness. The chronic cutaneous form of the disease, “farcy”, is more common in horses and causes generalized lymphadenopathy; multiple infected cutaneous lymph nodes fistulate and drain with induration, enlargement, and nodularity of regional lymphatics on the extremities and in other areas. The chronic form is characterized by flares and remissions over years. The mucous membrane form results in the highest mortality beginning as nasal ulcers and nodules that secrete bloody discharge and often lead to sepsis. The stellate scars in the nasal mucosa from healed ulcers are considered characteristic of the disease.

In the pulmonary form nodules and abscesses develop in the lungs. Some infections are inapparent; others vary from mild dyspnea to severe respiratory disease with coughing, dyspnea, high fever (41°C) and eventual septicemia. Horses with Glanders may die rapidly, or they may live for several years with chronic abscessation (most often regional lymph nodes, lungs, liver, spleen).

**The septicemic form of Glanders results in coughing, a high fever and release of an infectious nasal discharge, often followed by fulminant septicemia and death within days. Multi-organ abscesses develop predominantly in the lung, liver and spleen and often lead to septic shock.** Other lesions that can be seen are osteomyelitis, meningitis, orchitis or brain abscesses. Death may occur within 1-2 weeks or several months. Apparent survivors act as carriers. Zoo and wild felids consuming infected meat will develop localized nodules on nasal mucosa and bloody nasal discharge w/in 8-14 days after consuming contaminated meat.

**Post mortem, gross, or histologic findings:** In addition to the nasal ulcers and characteristic cutaneous lesions, Glanders induces a neutrophilic leukocytosis and anemia caused by depressed erythropoietic activity in the bone marrow. Gram stains of lesion exudates may reveal the organism.

**Diagnosis:** Complement Fixation (CF) is the official test. Unfortunately, in addition to false negative and false positive reactions, the test cannot differentiate *B. mallei* from *B. pseudomallei* (meliodosis) or an infected animal from a “malleinized” (has undergone a mallein test) animal. Automated bacterial identification systems do not always correctly identify this organism, which can be a significant problem when the index of suspicion for *B. mallei* infection is low. Final differentiation of cultures of *B. mallei* from *B. pseudomallei* can be done with rapid, low risk DNA testing at a designated laboratory (with 16S rRNA sequencing and the use of a variety of molecular typing methods: *flic* PCR, *flip* RT-PCR, etc.) A Western Blot test has been recently developed.

The “Mallein test” is the most commonly used test for Glanders and uses a protein fraction of the Glanders organism which is injected ID or intrapalpebrally or topically given by eye drop. In infected animals, palpebrae will swell markedly in 1-2 days. The test is used more frequently in domesticated animals in endemic regions, but the sensitivity and specificity of the test depend largely on what protein fraction is used. The Mallein test may give a false positive by cross reaction with *Streptococcus equi* and may also leave the horse with a positive CF test for Glanders.

**Material required for laboratory analysis:** Serum and/or tissue

**Relevant diagnostic laboratories:**

NVSL – Complement Fixation (515) 337-7200  
OIE Labs: http://www.oie.int/our-scientific-expertise/reference-laboratories/list-of-laboratories/

**Treatment:** No vaccine is available for animal or human use. Several promising avenues are currently being pursued. Information on antibiotic treatment is sparse and while gentamycin, azithromycin, doxycycline, ciprofloxacin and sulfonamides are thought to be effective for treatment in man and some laboratory animals,
mortality would likely still be high. As a rule, authorities forbid the treatment of Glanders horses outside endemic areas. Animals diagnosed with Glanders in non-endemic regions must be euthanized.

**Prevention and control:** Any equids entering the US or other non-endemic countries would be expected to have a negative CF testing for Glanders.

**Suggested disinfectant for housing facilities:** Decontamination can be achieved with common disinfectants (solutions of benzalkonium chloride, 1% sodium hypochlorite, 70% ethanol, 2% glutaraldehyde, iodine, mercuric chloride in alcohol, and potassium permanganate), heat treatment to >72°C (160°F), or by exposure to ultraviolet (UV) light.

**Notification:** In suspected cases of Glanders, USDA - AVIC and State Veterinarian should be alerted. Internationally, cases should be reported to the Office International des Epizooties (OIE List B Reportable Disease), the World Health Organization (WHO), and to the local veterinary authority in each country.

**Measures required under the Animal Disease Surveillance Plan:** Reportable disease

**Measures required for introducing animals to infected animal:** Infected animals would be isolated in endemic countries or euthanized in non-endemic countries.

**Conditions for restoring disease-free status after an outbreak:** Disinfection and euthanasia recommended. Isolation and testing of exposed animals if permitted.

**Experts who may be consulted:** NVSL and OIE personnel

**References:**


