



Pigeon Fever (*Corynebacterium pseudotuberculosis* infection)

Definition

Corynebacterium pseudotuberculosis is a gram-positive bacteria with worldwide distribution. In North America, cases have been reported throughout the United States. Infection has been reported in equids, sheep, goats, cattle, buffalo, camelids, and rarely humans. Biotypes isolated from small ruminants and camelids are nitrate negative, while those from horses are nitrate positive. Natural cross-species transmission does not occur between sheep and horses, however cattle can have infection from either biotype.

Clinical Signs

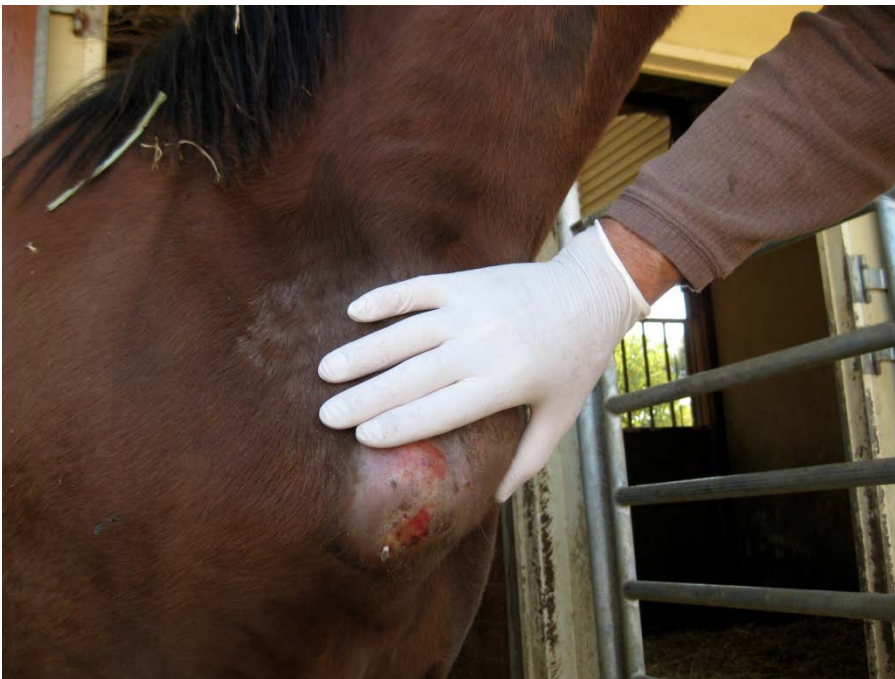
Three forms have been described in horses: ulcerative lymphangitis or limb infection, external abscesses and internal infection. Ulcerative lymphangitis and internal infection must be treated more aggressively with antimicrobial therapy, while use of antimicrobials for external abscesses is often unnecessary.

Ulcerative lymphangitis is the least common form seen in North America, although this form of disease has been reported worldwide. *Ulcerative lymphangitis* manifests as a severe limb swelling and cellulitis, with multiple draining tracts following lymphatics. Most commonly one or both hind limbs are affected. Horses often develop a severe lameness, fever, lethargy and anorexia. Aggressive medical therapy (antimicrobial and anti-inflammatory) is necessary or the disease often becomes chronic, resulting in limb edema, prolonged or recurrent infection, lameness, weakness, and weight loss.



Ulcerative lymphangitis (Photo by Sharon Spier, DVM, Ph.D, University of California, Davis)

External Abscesses are the most common manifestation, and may occur anywhere on the body, but most frequently develop in the pectoral region (swelling resembles a pigeon's breast) and along the ventral midline of the abdomen. Abscesses contain tan, odor-free purulent exudate and are usually well encapsulated. Additional sites for abscess formation are the prepuce, mammary gland, triceps, axilla, limbs, and head. Septic joints and osteomyelitis have been reported. Horses may have a single or multiple abscesses involving different regions of the body. Horses with external abscesses do not usually develop signs of systemic illness, however one-quarter will develop fever. If signs of systemic illness are present, further diagnostics to rule out internal infection are warranted, and antimicrobial therapy should be considered. While there is considerable variation in severity among horses, most straight – forward cases can be treated with lancing and draining the abscesses when mature. The case fatality for horses with external abscesses is very low (0.8%).



Typical pectoral abscess with flies attracted to exudates

(Photo by Sharon Spier, DVM, Ph.D, University of California, Davis)

Internal infection occurs in approximately 8% of affected horses, which is associated with a high case fatality rate (30 to 40%). Diagnosis can be challenging, and long-term antimicrobial therapy is imperative for successful outcome. In a retrospective study, the organs most commonly involved were liver, kidney, spleen and lungs. Abortion due to placentitis or fetal infection has been reported.

Transmission

The portal of entry of this soil-dwelling organism is thought to be through abrasions or wounds in the skin or mucous membranes. Many insects have been incriminated as vectors for the transmission of the disease to horses, and studies have shown that *Haematobia irritans*, *Musca domestica*, *Stomoxys calcitrans* can act as mechanical vectors of this disease. The regional location of abscesses suggests that ventral midline dermatitis is a predisposing cause of infection. Temporal and special analysis indicated an incubation period of 3 to 4 weeks. Within a geographic area, the disease appeared to be transmitted between 7 and 56 days throughout a 4.3 to 6.5 km distance, strongly suggesting that the disease could be transmitted through horse-to-horse contact or from infected to susceptible horses via insects, other vectors, or contaminated soil. The organism has been shown to survive for up to 2 months in hay and shavings, and more than 8 months in soil samples at environmental temperatures. The incidence of disease fluctuates considerably from year to year presumably due to herd immunity and environmental factors such as rainfall and temperature. Disease incidence is seasonal, with highest number of cases occurring during the dry months of the year, which is summer and fall in the Southwestern US, although cases may be seen all year. Horses with internal infection are more frequently seen one to two months following the peak number of cases with external abscesses.

Diagnostic Sampling, Testing and Handling

Bacterial culture of aspirates or exudate is used to confirm diagnosis and the organism survives for prolonged periods. *Corynebacterium pseudotuberculosis* grows well at 36°C on blood agar in 24 to 48 hours, and it forms small, pinpoint in diameter, whitish, opaque colonies that are surrounded by a weak zone of hemolysis. Biotypes isolated from small ruminants and camelids are nitrate negative, while those from horses are nitrate positive. *Corynebacterium pseudotuberculosis* produces various extracellular exotoxins, which play a role in virulence; the most studied is phospholipase D (PLD). The bacterial phospholipase D is similar to the PLD of the brown recluse spider, which explains the presence of pain and edema at the site of infection. The synergistic activity of *C. pseudotuberculosis* exotoxins with the exotoxins of *Rhodococcus equi* in lysing red blood cells in agar forms the basis for the synergistic hemolysis inhibition (SHI) test. The SHI test is used to detect IgG antibody to *C. pseudotuberculosis* in horses with internal infections where external abscesses are not present.

Clinical pathologic abnormalities that may be observed include anemia of chronic disease, leukocytosis with neutrophilia, hyperfibrinogenemia, and hyperproteinemia. These hematological parameters can occur with either internal or external abscesses but are more consistently observed with internal abscesses.

A diagnosis of *internal infection* is based on clinical signs, clinicopathologic data, serology, diagnostic imaging and bacterial culture. The most common clinical signs are concurrent external abscesses, decreased appetite, fever, lethargy, weight loss, and signs of respiratory disease or abdominal pain. Other signs observed in horses with internal abscesses include ventral edema, ventral dermatitis, ataxia, hematuria (due to renal abscesses), and uncommonly, abortion.

Serologic testing using the Synergistic Hemolysis Inhibition (SHI) test can be useful in aiding the diagnosis of internal abscesses and is available through the [California Animal Health and Food Safety Laboratory System](#) in Davis, California, and the [Colorado State University Veterinary Diagnostic Laboratories](#) in Fort Collins, Colorado. Serology is generally not helpful for diagnosis of external abscesses and may be negative early in the course of disease and even the time of abscess drainage. Positive SHI titers must be interpreted carefully and combined with clinical signs to distinguish active infection from exposure or convalescence. Both published and unpublished data from the University of California suggests a reciprocal titer of ≥ 256 is indicative of active infection. Horses with internal abscesses generally have SHI titers ≥ 512 . Titers ≤ 16 are considered negative, while titers between 16 and 128 are considered suspicious or indicative of exposure. These are rough guidelines, however, as there is considerable overlap in results from horses with active disease, exposure and recovery from infection. *The SHI test is most accurate for diagnosis of internal infection in **the absence** of external abscesses. The SHI test should not be used alone to diagnose internal infection without other supportive diagnostics.*

Abdominal ultrasonography is the most useful tool for identifying affected internal organs and also for revealing the nature and extent of involvement. Abdominal ultrasonography also facilitated transcutaneous liver and kidney biopsy procedures and aspiration of abscess fluid for definitive diagnosis. Ultrasonography should be used in conjunction with hematologic and serum biochemical analyses to monitor response to treatment and may be the only available modality to monitor horses in which there is no clinicopathologic evidence of organ disease.

Environmental Persistence

The organism has been shown to survive for up to 2 months in hay and shavings, and more than 8 months in soil samples at environmental temperatures. In experimental studies, the presence of manure favored survival and replication of bacteria in soil.

Specific Control and Treatment Measures

Biosecurity Measures

Implementation of biosecurity practices to limit the spread of *Corynebacterium pseudotuberculosis* are aimed at reducing environmental contamination and spread via insects or fomites. The bacterium is endemic in many regions of the world and survives for months in soil, particularly when contaminated with manure.

- Wearing of disposable examination gloves when working with affected horses followed by hand washing is indicated.
- Isolation of affected horses from naive herd mates
- Protecting horses from insect exposure by regular application of insect repellants to the horse including the ventral midline (prevention of ventral midline dermatitis).
- Meticulous wound care (topical fly repellants, antimicrobial ointments and bandages) to prevent infection from a contaminated environment

Vaccination

There is currently no licensed commercially available vaccine in the United States for control of *Corynebacterium pseudotuberculosis* in horses. Use of autogenous bacterin - toxoids designed for horses demonstrated increased SHI titers following 2 injections, however the protection remains to be established. A commercial bacterin - toxoid is clearly needed to protect horses as the disease becomes endemic in more geographic regions.

Treatment

The treatment regimen for external abscesses must be individualized for each horse depending on the severity of disease, including the presence of systemic illness such as fever or anorexia, the extent of soft tissue inflammation, the maturity of the abscess and the ability to successfully establish drainage of purulent exudate. Establishing drainage is the most important treatment and ultimately leads to faster resolution and return to athletic performance. The proximity of the fibrous abscess capsule to the skin varies, often being <1 cm deep for ventral midline abscesses, to greater than 10 cm deep underlying muscle for some pectoral, axillary, triceps or inguinal abscesses. Aspiration and drainage of superficial abscesses is easily performed, however the use of diagnostic ultrasound is helpful for localization of deeper abscesses and to judge maturity of the abscess and proximity to the skin. The abscess contents and lavage solutions such as saline with or without antiseptic should be retrieved and disposed of to prevent further contamination of the immediate environment.

Antimicrobial therapy

Antimicrobials are indicated for horses with ulcerative lymphangitis and for horses with internal abscesses. The use of antimicrobials for external abscesses is not necessary in many horses and may prolong the time to resolution. Antimicrobial therapy may be justified when signs of systemic illness are present, such as fever, depression and anorexia, or when extensive cellulitis or lameness is present. Horses with deep intramuscular abscesses that are lanced and draining through healthy tissue may also benefit from antimicrobial therapy.

Corynebacterium pseudotuberculosis is susceptible *in vitro* to many antimicrobials commonly used in horses, including penicillin G, macrolides, tetracyclines, cephalosporins, chloramphenicol fluoroquinolones and rifampin. Several factors should be considered when choosing an antimicrobial. The intracellular location of the organism, the presence of exudates and a thick abscess capsule, and the duration of therapy are important as are the cost of the drug and the convenience of administration. Despite *in vitro* susceptibility, the nature of the bacteria and the copious exudate render certain antimicrobials ineffective for some cases. Trimethoprim-sulfa (5 mg/kg based on the trimethoprim fraction, twice daily orally) or procaine penicillin (20,000 U/kg twice daily intramuscularly) are effective for external abscesses especially on the ventral midline. Rifampin (2.5-5 mg/kg twice daily orally) in combination with ceftiofur (2.5 – 5 mg/kg twice daily intravenously or intramuscularly) appears highly effective for treatment of internal abscesses. Internal abscesses have also responded favorably to enrofloxacin (7.5 mg/kg once daily orally). The average duration of antimicrobial

therapy for internal infection is 4-6 weeks, and is best determined by repeat abdominal ultrasound and clinicopathologic results.

Horses with *ulcerative lymphangitis* or cellulitis should be treated early and aggressively with antimicrobials or residual lameness or limb swelling may occur. Typically intravenous antimicrobials (ceftiofur or penicillin G) alone or in combination with rifampin (orally) are used until lameness and swelling improves, and then therapy with orally administered antimicrobials such as trimethoprim sulfamethoxazole or rifampin are continued to prevent relapse. The time to resolution reported in one study was approximately 35 days. Physical therapy, including hydrotherapy, hand walking, and leg wraps, as well as NSAIDs are recommended.

Biosecurity Management for Receipt of Animals

Once horses are recovered and there is no drainage from abscesses no precautions should be needed to reduce the risk these horses pose for spread of infection. There is no practical way at this time for eliminating the bacteria from soil.

Zoonotic Potential

There exist few reports of human illness through working with infected sheep, mostly in Australian sheep shearers who had open wounds on their hands and developed axillary lymphadenitis. One veterinary student from California developed pneumonia following exposure to an infected horse, presumably from inhalation of the bacteria from a contaminated environment.