



PIGEON FEVER (*Corynebacterium pseudotuberculosis* Infection)

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Definition *Corynebacterium pseudotuberculosis* is a gram-positive bacteria with worldwide distribution. *Corynebacterium pseudotuberculosis* is considered an emerging disease in North America; cases have been reported throughout the United States. Outbreaks in areas in which the bacteria had previously not been or had only rarely been reported have occurred during times of drought. Infection has been reported in equids, sheep, goats, cattle, buffalo, camelids, and on rare occasions, 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 of PF have been described in horses: external abscesses, internal infection, and ulcerative lymphangitis or limb infection. Ulcerative lymphangitis and internal infection must be treated more aggressively with antimicrobial therapy, while use of antimicrobials for external abscesses is generally unnecessary.

Corynebacterium pseudotuberculosis produces various extracellular exotoxins which play a role in virulence and explain the presence of pain and edema at the site of infection.

External Abscesses

- Are the most common manifestation, with single or multiple abscesses. May occur anywhere on the body, but most frequently in the pectoral region (swelling resembles a pigeon's breast) and along the ventral midline
- Additional sites for abscess formation are the prepuce, mammary gland, triceps, axilla, limbs, and head. Septic joints and osteomyelitis have been reported
- Abscesses contain tan, odor-free purulent exudate and are usually well encapsulated. 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, and is associated with a high case fatality rate (30 to 40%). Diagnosis can be challenging, and long-term antimicrobial therapy is imperative for a 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. Horses with internal infection are more frequently seen one to two months following the peak number of cases with external abscesses.

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)

Incubation Period

Temporal and spatial analysis indicated an incubation period of 3 to 4 weeks

Risk Factors

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 the 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.

Transmission

The portal of entry is soil contamination of abrasions or wounds in the skin or mucous membranes.

Many insects have been incriminated as vectors for the transmission of the disease to horses; studies have shown that *Haematobia irritans*, *Musca domestica*, and *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. 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.



**Diagnostic
Sampling,
Testing and
Handling**

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

Clinical pathologic abnormalities that may be observed include

- anemia of chronic disease
- leukocytosis with neutrophilia
- hyperfibrinogenemia
- hyperproteinemia.

These hematological parameters can occur with either internal or external abscesses but are more consistently observed with internal abscesses.

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](#), the [Washington Animal Disease Diagnostic Lab](#), the [Texas Veterinary Medical Diagnostic Laboratory](#), and the [Colorado State University Veterinary Diagnostic Laboratories](#). The SHI test is used to detect IgG antibody to *C. pseudotuberculosis* in horses with active infections and is useful in identifying internal infections in horses without external abscesses. 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.

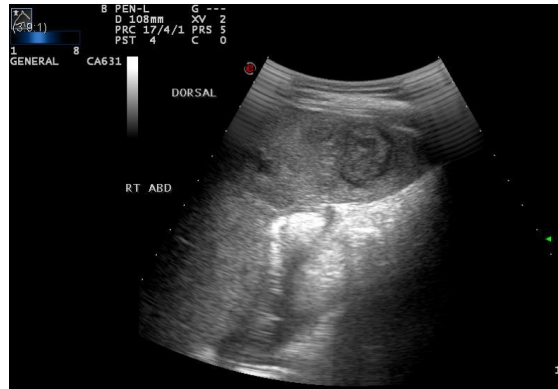
University of California data:

- Reciprocal titer of ≥ 256 is indicative of active infection
- Internal abscesses generally have SHI titers ≥ 512
- Titers ≤ 16 are considered negative
- Titers between 16 and 128 are considered suspicious or indicative of exposure. 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 for revealing the nature and extent of involvement. Abdominal ultrasonography also facilitates 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.



Ultrasound image of hepatic abscess due to *Corynebacterium pseudotuberculosis* infection. Image by Tracy Norman, VMD DACVIM,



Ultrasound image of pulmonary abscess due to *Corynebacterium pseudotuberculosis* infection. Image by Tracy Norman, VMD DACVIM,

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 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.

Suggested Biosecurity Measures

- Wear disposable examination gloves followed by hand washing
- Isolate affected horses from naive herd mates



- Protect horses from insect exposure by regular application of insect repellent, particularly to the ventral midline (prevention of ventral midline dermatitis)
- Practice meticulous wound care (topical fly repellents, 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 has demonstrated increased SHI titers following 2 injections, however the protection remains to be established.

Treatment

The treatment regimen for external abscesses must be individualized for each horse depending on the severity of disease, 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. 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. Horses with deep intramuscular abscesses that are lanced and draining through healthy tissue may also benefit from antimicrobial therapy.

- 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



Considerations: 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.

Corynebacterium pseudotuberculosis is susceptible *in vitro* to many antimicrobials commonly used in horses, including penicillin G, macrolides, tetracyclines, cephalosporins, chloramphenicol, fluoroquinolones and rifampin.

Despite *in vitro* susceptibility, the nature of the bacteria and the copious exudate render certain antimicrobials ineffective for some cases.

External abscesses especially on the ventral midline

- trimethoprim-sulfa (30 mg/kg twice daily orally) or procaine penicillin (20,000 U/kg twice daily intramuscularly) are effective for internal abscesses
- 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. Also, 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 serial ultrasound and clinicopathologic results.

Ulcerative lymphangitis or cellulitis

- Horses should be treated early and aggressively with antimicrobials to minimize the possibility of residual lameness or limb swelling
- 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 sulfa 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
Issues for
Receiving
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 to eliminating the bacteria from soil.

**Zoonotic
Potential**

There exist a 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.