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Corynebacterium pseudotuberculosis infection in a 10-year-old male West African Dongola horse in the Zoological Garden, University of Ibadan: a case report

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Abstract

Corynebacterium pseudotuberculosis is a gram-positive bacterium that affects several animals, including horses. The present report presents a case of a 10-year-old male West African Dongola horse that developed an external abscess caused by *C. pseudotuberculosis* in the Zoological Garden, University of Ibadan. The patient was presented to the garden veterinary clinic with a complaint of lameness, pus discharge, and swelling on the right forelimb. The pulse rate and temperature were within normal range. Blood was collected from the jugular vein for a complete blood count (CBC) and serum chemistry. A pus sample was collected and subjected to bacterial culture, gram staining, biochemical tests, and an antimicrobial susceptibility test. *Corynebacterium pseudotuberculosis* was isolated and identified in pure culture from aspirates of the pus discharge based on cultural, gram-staining, and biochemical characteristics. The organism was sensitive to gentamicin, amoxicillin, and ciprofloxacin. A warm compress, wound irrigation, and bandage were applied to the infected area. The antibiotics used were a combination of amoxycillin and gentamycin injections. Other drugs used include tetanus toxoid injection, tetanus antitoxin injection, and diclofenac sodium injection. The therapy was successful, and the patient completely recovered. Good sanitation and prompt wound care are recommended.

Keywords: *Corynebacterium pseudotuberculosis*; Abscess; Bacteria culture; Pus; Biochemical test.

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Introduction

Corynebacterium pseudotuberculosis is a gram-positive, facultative, intracellular, pleomorphic bacterium found across the world (Biberstein and Hirsh, 1999). *Corynebacterium pseudotuberculosis* infection has been documented in equids and other animals, including goats, cattle, buffalo, sheep, camelids, and humans (Spier, 2006). There are two genetically separate biovars: *biovar equi*, which affects horses and is nitrate positive, and *biovar ovis*, which affects goats and sheep and is nitrate negative (Spier and Azevedo, 2017).

The route of infection is uncertain; however, it is thought that the bacterium enters the horse through skin abrasions (Spier et al., 2004). Spier et al. (2004) discovered that insects such as the stable fly (*Stomoxys calcitrans*), horn fly (*Haematobia irritans*), and house fly (*Musca domestica*) operate as vectors. There are three clinical manifestations in infected horses: (1) muscular or subcutaneous abscess, primarily in the abdominal and pectoral regions; (2) internal infection resulting in visceral abscess (kidney, liver, spleen, and lungs); and (3) ulcerative lymphangitis, which causes limb inflammation, cellulitis, and severe lameness (Aleman et al., 1996).

Pure cultures can be obtained from the lesions. While abdominocentesis detects abdominal abscesses, normal peritoneal fluid does not rule them out. Ultrasonography can help detect deep abscesses in the inguinal, abdominal, or axillary regions (Jeske et al., 2013).

The treatment is typically curative and comprises antibiotic therapy and abscess drainage. Good hygiene and management, including early wound care and thorough insect control, are the most effective means of prevention (Corbeil et al., 2016).

Here, a case report of a 10-year-old male West African Dongola horse that developed an external abscess in the Zoological Garden, University of Ibadan, caused by *C. pseudotuberculosis* is described.

Case details

History, clinical examination, and sample collection

A 10-year-old male West African Dongola horse, weighing 301kg and stabled at the Zoological Garden, University of Ibadan, was presented to the garden clinic. The main complaints, according to the caregivers, were lameness (Fig. 1), abscess swelling (Fig. 2), and pus discharges (Fig. 3) on the right forelimb. The patient was said to have had a puncture wound on the same right forelimb a few days before presentation. The pulse rate (36 beats/min) and temperature (37.9 °C) were within the normal range. Blood was collected from the jugular vein for complete blood count (CBC) and serum chemistry; the values obtained were compared with the reference laboratory values documented by Radostits et al. (2006).

Aspirates of pus were aseptically collected from the abscess on the right forelimb and subjected to bacterial cultures, gram staining, biochemical tests, and an antimicrobial susceptibility test.

Fig. 1: Horse showing sign of lameness at presentation

Fig. 2: Abscess swelling on the right forelimb (white arrow)

Fig. 3: White arrow showing pus discharge

Laboratory result

The complete blood count showed that the horse had leucocytosis due to neutrophilia (Table 1). The serum biochemistry results showed that the horse had hyperproteinaemia due to hyperalbuminaemia (Table 2).

Table 1: Haematology result

Blood parameter	Value	Reference value (source: Radostits et al., 2006)	Inference
Plasma colour	Clear, straw-yellow		Normal
Fibrinogen (mg/dL)	300	200-400	Normal
Hb (g/dL)	11.2	11-19	Normal
PCV (%)	35	32-53	Normal
RBC (X 10^6/µL)	7.22	6.8-12.9	Normal
MCV (fl)	57	37-59	Normal
MCHC (g/dL)	32	31-38.6	Normal
Platelets (/µL)	118000	100000-600000	Normal
Total WBC (µL)	16700	5400-14300	Leucocytosis
Seg. Neutrophils (/µL)	13100	2300-8500	Neutrophilia
Band Neutrophils (/µL)	100	0-100	Normal

Lymphocytes (/µL)	**2200**	**1500-7700**	**Normal**
Monocytes (/µL)	**700**	**0-1000**	**Normal**
Eosinophils (/µL)	**600**	**0-1000**	**Normal**
Basophils (/µL)	**0**	**0**	**Normal**

Table 2: Serum chemistry result

Serum parameter	Value	Reference value (source: Radostits et al., 2006)	Inference
Total protein (g/dL)	**8.1**	**6-7.7**	**Hyperproteinaemia**
Albumin (g/dL)	**4.2**	**2.9-3.8**	**Hyperalbuminaemia**
Globulin (g/dL)	**3.9**	**3.1-3.9**	**Normal**
AST (µL)	**260**	**220-600**	**Normal**
SDH (µL)	**1.9**	**1.9-5.8**	**Normal**
BUN (mg/dL)	**16**	**10-24**	**Normal**
Creatinine (mg/dL)	**1.5**	**0.0-1.9**	**Normal**

Nonmotile, gram-positive pleomorphic rods were seen in smears prepared from pure culture. Also, some of the biochemical tests on the organism showed catalase positive, oxidase negative, nitrate reduction positive, urease negative, glucose positive, maltose positive, lactose negative, mannitol negative, and xylose negative (Table 3). Bacterial cultures followed by gram staining and biochemical tests confirmed *Corynebacterium pseudotuberculosis.*

Based on the antimicrobial susceptibility test, *Corynebacterium pseudotuberculosis* was sensitive to gentamicin, amoxicillin, and ciprofloxacin and insensitive to metronidazole and streptomycin (Table 4; Fig. 4).

Table 3: Biochemical tests

Biochemical Characteristics	*Corynebacterium spp. Isolate*
Gram Staining	Gram-positive short rods
Catalase	Positive
Oxidase	Negative
Nitrate reduction	Positive
Motility	Non-motile
Methyl-red	Positive

Hydrogen sulphide production	Positive
Indole production	Negative
Citrate	Negative
Voges-proskauer	Negative
Urease Test	Negative
OF (Oxidative-Fermentative)	Fermentative
TSI Agar	Alkaline slant, acidic butt, and presence of gas
Glucose	Positive
Maltose	Positive
Lactose	Negative
Mannitol	Negative
Xylose	Negative
Sucrose	Negative
Arabinose	Positive

Table 4: Antimicrobial susceptibility test

Animal Type	Sensitive	Intermediate	Resistant
Equine (Horse)	Gentamicin Amoxicillin Ciprofloxacin	Tetracycline, Doxycycline, Chloramphenicol Enrofloxacin Ceftriaxone	Metronidazole Streptomycin

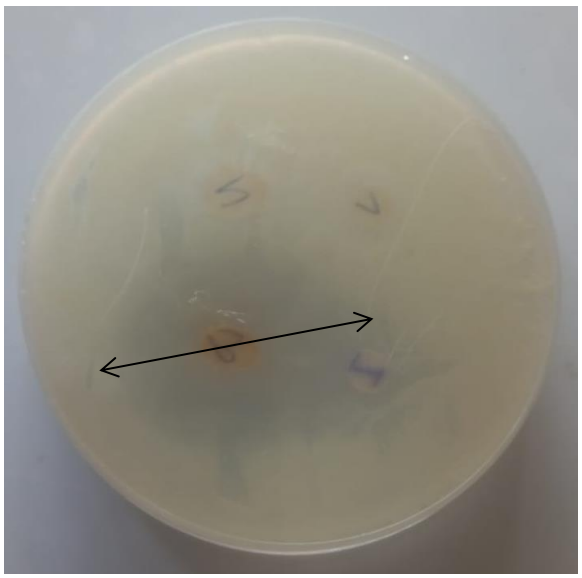

Fig. 4: Antimicrobial susceptibility test showing a wide zone of inhibition with gentamycin (black arrow)

Treatment and outcome

A warm compress was applied to the abscess using a clean washcloth and warm water. It was placed over the abscess for two days to expel the pus, thereby reducing the abscess swelling. The wound was copiously irrigated with normal saline, dried, and covered with a bandage, which was changed every other day.

Tetanus toxoid injection (Tetanus toxoid® 1 ml/horse, Zoetis Inc., Kalamazoo, USA) was administered intramuscularly; tetanus antitoxin injection (Tetanus antitoxin® 1500 IU/horse, Jiangxi Institute of Biological Products Inc., China) was administered intramuscularly; diclofenac sodium injection (Jawa diclofenac® 1.1 mg/kg, Jawa Group, Lagos, Nigeria) was administered intramuscularly for 3 days; and Amoxycillin and Gentamycin injection (Biogenta® 1 ml/10 kg, Interchemie werken "De Adelaar" BV, The Netherlands) was administered intramuscularly for 7 days.

The patient recovered; the abscess swelling subsided with complete healing (Fig. 5).

Fig. 5: Out come after treatment showing resided abscess swelling (red arrow) and complete healing (white arrow).

Discussion

The present case reveals an external abscess on the horse's right forelimb. External abscesses are most commonly found in the pectoral region and the ventral abdomen (Corbeil et al., 2016). However, Nogradi et al. (2012) established that the limbs and other regions, such as the prepuce, mammary gland, triceps, and head, can also be affected. It is believed that the puncture wound, which occurred a few days before presentation, predisposed the horse to the infection.

The infected horse had various clinical signs of the disease seen in horses with *Corynebacterium pseudotuberculosis,* which agreed with the findings of Pratt et al. (2005), Zavoshti et al. (2009), and Muñoz-Bucio et al. (2017).

The haematological examination revealed neutrophilia, which was also reported by Gonzalez et al. (2008). The hyperproteinaemia is indicative of dehydration, as established by Boyd (1981). Based on the bacteria culture, gram staining, and biochemical test, *Corynebacterium pseudotuberculosis* was confirmed. The nonmotile, gram-positive pleomorphic rods seen in smears prepared from the pure culture are consistent with the reports of Coyle and Lipsky (1990) and Dorella et al. (2006).

Biochemical tests carried out in this case confirmed the presence of *C. pseudotuberculosis* and are in agreement with studies on the speciation of *C. pseudotuberculosis* (Funke et al., 1997; Dorella et al., 2006; Chahota et al., 2017).

The present case shows that the *Corynebacterium pseudotuberculosis* isolate was nitrate reduction positive, proving the organism to be an *equi-biovar*. This is expected because the organism was isolated from a horse. The nitrate test results for *C. pseudotuberculosis* might vary. This is due to the presence of two biovars: *biovar equi* (from cattle or horses), which reduces nitrate, and *biovar ovis* (from goats or sheep), which does not (Coyle and Lipsky, 1990).

Corynebacterium pseudotuberculosis was only sensitive to gentamicin, amoxicillin, and ciprofloxacin in the present case. Studies have found the bacteria to be resistant to a wide variety of antibiotics (Muckle and Gyles, 1982). This suggests that the susceptibility of *C. pseudotuberculosis* to antimicrobial drugs differs among isolates derived from different sources.

Warm compress used in the present case was intended to reduce swelling, encourage evacuation of all purulent matter, and speed up healing. Normal saline, a nontoxic, isotonic solution that does not harm healing tissues, was used to irrigate the infected wound to physically remove cellular debris and trapped fluids and lower the bacterial load (Ambe et al., 2020). The bandage was used to collect pus from the wound, provide proper healing conditions, and protect the area until the wound healed. Tetanus antitoxin and tetanus toxoid were both administered to the patient since tetanus antitoxin only protects for 1–3 weeks, whereas tetanus toxoid provides long-term immunity.

The antibiotics employed, combination of amoxycillin and gentamycin injection, were chosen based on antimicrobial susceptibility testing, and they performed admirably. In conclusion, this case reports the diagnosis and successful treatment of a *C. pseudotuberculosis* infection in a West African Dongola horse stabled at the Zoological Garden, University of Ibadan. Hence, good sanitation and prompt wound care are recommended.

Reference

Aleman M, Spier SJ, Wilson WD and Doherr M (1996). Corynebacterium pseudotuberculosis infection in horses: 538 cases (1982-1993). Journal of the American Veterinary Medical Association, 209(4): 804-809.

Ambe PC, Rombey T, Rembe JD, Dörner J, Zirngibl H and Pieper D (2020). The role of saline irrigation prior to wound closure in the reduction of

surgical site infection: a systematic review and meta-analysis. Patient Safety in Surgery, 14(1): 1-8.

Biberstein EL and Hirsh DC (1999). Corynebacteria; Arcanobacterium (Actinomyces) pyogenes; Rhodococcus equi. Veterinary Microbiology. Malden, MA: Blackwell Science, Inc, 127-34.

Boyd JW (1981). The relationships between blood haemoglobin concentration, packed cell volume and plasma protein concentration in dehydration. British Veterinary Journal, 137(2): 166-172.

Chahota R, Bhardwaj B, Gupta S, Patial V and Sharma M (2017). Isolation and Identification of Microorganisms from the Upper Respiratory Tract of Equines in Himachal Pradesh. Journal of Animal Research, 7(1): 209-212.

Corbeil LE, Morrissey JK and Léguillette R (2016). Is Corynebacterium pseudotuberculosis infection (pigeon fever) in horses an emerging disease in western Canada?. The Canadian Veterinary Journal, 57(10): 1062.

Coyle MB and Lipsky BA (1990). Coryneform bacteria in infectious diseases: clinical and laboratory aspects. Clinical Microbiology Reviews, 3(3): 227-246

Dorella F, Pacheco LGC, Oliveira S, Miyoshi A and Azevedo V (2006). Corynebacterium pseudotuberculosis: microbiology, biochemical properties, pathogenesis and molecular studies of virulence. Veterinary research, 37(2): 201-218.

Funke G, von Graevenitz ALEXANDER, Clarridge 3rd JE and Bernard KA (1997). Clinical microbiology of coryneform bacteria. Clinical microbiology reviews, 10(1): 125-159.

Gonzalez M, Tibary A, Sellon DC and Daniels J (2008). Unilateral orchitis and epididymitis caused by Corynebacterium pseudotuberculosis in a stallion. Equine Veterinary Education, 20(1): 30-36.

Jeske JM, Spier SJ, Whitcomb MB, Pusterla N and Gardner IA (2013). Use of antibody titers measured via serum synergistic hemolysis inhibition testing to predict internal Corynebacterium pseudotuberculosis infection in horses. Journal of the American Veterinary Medical Association, 242(1): 86-92.

Muckle CA and Gyles CL (1982). Characterization of strains of corynebacterium pseudotuberculosis. Canadian Journal of Comparative Medicine, 46(2): 206.

Muñoz-Bucio AV, Cortés-Pérez YA, Arellano-Reynoso B, Hernández-Gil M, Hernández-Castro R and Díaz-Aparicio E (2017). Identification of Corynebacterium pseudotuberculosis isolated from muscular abscesses in two horses: first report in Mexico. Equine Veterinary Education, 29(8): 431-435.

Nogradi N, Spier SJ, Toth B and Vaughan B (2012). Musculoskeletal Corynebacterium pseudotuberculosis infection in horses: 35 cases (1999–2009). Journal of the American Veterinary Medical Association, 241(6): 771-777.

Spier SJ and Jeske J (2017). Corynebacterium pseudotuberculosis. Interpretation of Equine Laboratory Diagnostics, 171-175.

Radostits OM, Gay C, Hinchcliff KW and Constable PD (Eds.). (2006). Veterinary Medicine E-Book: A textbook of the diseases of cattle, horses, sheep, pigs and goats. Elsevier Health Sciences.

Spier SJ (2006). Dryland Distemper-Corynebacterium pseudotuberculosis infections in horses. California Vet, 38: 24-26.

Spier SJ and Azevedo V (2017). Corynebacterium pseudotuberculosis infection in horses: Increasing frequency and spread to new regions of North America. Equine Veterinary Education, 29(8): 436-439.

Spier SJ, Leutenegger CM, Carroll SP, Loye JE, Pusterla JB, Carpenter TE, Mihalyi J. E and Madigan JE (2004). Use of a real-time polymerase chain reaction-based fluorogenic 5'nuclease assay to evaluate insect vectors of Corynebacterium pseudotuberculosis infections in horses. American journal of veterinary research, 65(6): 829-834.

Zavoshti FR, Sioofy-Khojine AB and Mahpeikar HA (2009). A case report of ulcerative lymphangitis (a mini review of causes and current therapies). Turkish Journal of Veterinary & Animal Sciences, 33(6): 525-528.