Canine Brucellosis: *Brucella canis*

Contagious Abortion, Undulant Fever

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Importance

Canine brucellosis, caused by *Brucella canis*, is an important cause of reproductive failure, particularly in kennels. *B. abortus* causes abortions, stillbirths, epididymitis, orchitis and sperm abnormalities in dogs. Canine brucellosis can end the reproductive career of a breeding animal. *B. canis* is zoonotic, although disease appears to be rare in humans.

Etiology

In dogs, brucellosis is mainly caused by *Brucella canis*, a Gram-negative coccobacillus or short rod. This organism is a facultative intracellular pathogen. Other *Brucella* species occasionally associated with disease in dogs include *Brucella abortus*, *B. melitensis* and *B. suis*. (For information on these organisms, see the factsheets titled "Bovine Brucellosis," "Ovine and Caprine Brucellosis," and "Porcine Brucellosis" respectively.) Genetic and immunologic evidence suggests that all members of the genus *Brucella* are closely related, and some microbiologists have proposed that this genus be reclassified into a single species (*B. melitensis*), which contains many biovars. This proposal is controversial, and both taxonomic systems are currently in use. The multiple species nomenclature is used in this factsheet.

Species Affected

Dogs are the only species known to be affected by *B. canis*; however, antibodies to this organism have been found in other carnivores. Experimental infections can be established in domesticated livestock and chimpanzees; however, these species are considered highly resistant to natural exposure. *B. canis* is zoonotic, but human infections seem to be uncommon.

Geographic Distribution

B. canis has been reported from the United States (particularly the southern states), Canada, Central and South America (including Mexico) some European countries, Tunisia, Nigeria, Madagascar, Malaysia, India, Korea, Japan and China. *B. canis* is probably found throughout most of the world; however, New Zealand and Australia appear to be free of this organism.

Transmission

B. canis occurs in the fetus, placenta, fetal fluids and vaginal discharge after an abortion or stillbirth. This organism can be found in vaginal discharges for 4 to 6 weeks after an abortion. It is also shed in normal vaginal secretions, particularly during estrus, as well as in milk. High concentrations of *B. canis* are found in semen for up to two months after infection, and intermittent shedding of smaller quantities can occur for years. *B. canis* is also found in urine, and low concentrations of bacteria may be excreted in saliva, nasal and ocular secretions, and feces.

In dogs, *B. canis* is mainly transmitted by contact with the fetus and fetal membranes after abortions/stillbirths, or by venereal transmission. This organism primarily enters the body by ingestion and through the genital, oronasal and conjunctival mucosa, but transmission through broken skin may also be possible. *In utero* infections occur. Nursing puppies can be infected from milk, but the importance of this route is controversial. Other potential sources of infection include blood transfusions and contaminated syringes. Dogs often become chronically infected with *B. canis* and can shed this organism for prolonged periods. Although some dogs clear the infection after a year, others remain bacteremic for five years and possibly longer.

B. canis can also be spread on fomites. In conditions of high humidity, low temperatures, and no sunlight, *Brucella* spp. can remain viable for several months in water, aborted fetuses, feces, equipment and clothing. *Brucella* species can withstand drying, particularly when organic material is present, and can survive in dust and soil. Survival is longer when the temperature is low, particularly when it is below freezing.

Humans usually become infected with *Brucella* spp. by ingesting organisms or by the contamination of mucous membranes and abraded skin. Infection with *B. canis* seems to require close contact with infected dogs or contact with bacterial cultures.

Incubation Period

Dogs usually become bacteremic two to three weeks after infection. The period between infection and reproductive signs is variable; abortions are most common at approximately 7 to 9 weeks of gestation. Early embryonic deaths 2 to 3 weeks after venereal transmission have also been reported.

Clinical Signs

B. canis can cause abortions and stillbirths in pregnant dogs. Most abortions occur late, particularly during the seventh to the ninth week of gestation. Abortions are usually followed by a mucoid, serosanguinous or gray-green vaginal discharge that persists for up to six weeks. Early embryonic deaths and resorption have been reported a few weeks after mating, and may be mistaken for failure to conceive. Some pups are born live but weak; these pups often die soon after birth. Other congenitally infected pups can be born normal and later develop brucellosis. Clinical signs occur during subsequent pregnancies in some dogs, but not in others.

The sperm may have morphological abnormalities and reduced viability in some infected males. Epididymitis, scrotal edema and orchitis may also be apparent. Scrotal dermatitis can occur due to self-trauma. Unilateral or bilateral testicular atrophy can be seen in chronic infections, and some males become infertile.

Lymphadenitis is common in infected dogs. The retropharyngeal lymph nodes may enlarge after oral infection, and the superficial inguinal and external iliac nodes after vaginal infection. Generalized lymphadenitis is also common. Other symptoms that are occasionally reported include lethargy or fatigue, exercise intolerance, decreased appetite, weight loss and behavioral abnormalities (loss of alertness, poor performance of tasks); however, most affected dogs do not appear seriously ill. Occasionally, diskospondylitis of the thoracic and/or lumbar vertebrae can cause stiffness, lameness or back pain. Uveitis, endophthalmitis, polygranulomatous dermatitis, endocarditis and meningoencephalitis have also been reported. Fever is rare. Many infected dogs remain asymptomatic.

Dogs with brucellosis may recover spontaneously, beginning a year after infection, but recovery is more common after 2 to 3 years, and some dogs remain chronically infected for at least five years. Deaths are rare except in the fetus or newborn.

Post Mortem Lesions

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The lymph nodes are often enlarged in affected animals. The retropharyngeal and inguinal lymph nodes are often involved, but generalized lymphadenitis also occurs. The spleen is frequently enlarged, and may be firm and nodular. Hepatomegaly may also be seen. Scrotal edema, scrotal dermatitis, epididymitis, orchitis, prostatitis, testicular atrophy and fibrosis occur in some infected males, and metritis and vaginal discharge may be seen in females. Less commonly reported lesions include diskospondylitis, meningitis, focal non-suppurative encephalitis, osteomyelitis, uveitis, and abscesses in various internal organs.

Aborted puppies are often partially autolysed and have evidence of generalized bacterial infection. Fetal lesions can include subcutaneous edema, subcutaneous congestion and hemorrhages in the abdominal region, serosanguinous peritoneal fluid, and degenerative lesions in the liver, spleen, kidneys and intestines.

Morbidity and Mortality

All breeds of dogs are susceptible to canine brucellosis. The prevalence of infection is unknown. A seroprevalence rate of 30% has been reported in Central and South America. In the southern U.S., approximately 6% of dogs, overall, have antibodies to *B. canis*. Infections are particularly common in stray and feral dogs, and less common in pets.

B. canis spreads rapidly in confined populations, particularly during breeding or when abortions occur. Although death is rare, except in the fetus and neonate, significant reproductive losses can be seen, particularly in breeding kennels. Up to 75% fewer puppies may be weaned from affected kennels.

Diagnosis

Clinical

Canine brucellosis should be considered when abortions and stillbirths are seen, particularly late in gestatation, or when male dogs develop epididymitis and testicular atrophy. Some infected dogs are asymptomatic or have only nonspecific signs such as lymphadenitis.

Differential diagnosis

The differential diagnosis includes beta-hemolytic streptococci, *Escherichia coli, Mycoplasma*, *Ureaplasma*, *Streptomyces*, *Salmonella*, *Campylobacter*, canine herpesvirus, *Neospora caninum* and *Toxoplasma gondii*.

Laboratory tests

Serology can be used for a presumptive diagnosis. Serological tests for *B. canis* include rapid slide agglutination (card or RSAT) tests, tube agglutination, an indirect fluorescent antibody (IFA) test, agar gel immunodiffusion and enzyme-linked immunosorbent assays (ELISA). Other tests such as complement fixation and counter-immunoelectrophoresis are used mainly in research. Titers vary between individuals and with the detection method. Cross-reactions between *B. canis* and other Gram-negative bacteria can occur in some tests, particularly agglutination tests. Nonspecific agglutination reactions also occur in some dogs.

A definitive diagnosis can be made if *B. canis* is cultured from an animal. *Brucella* spp. can be isolated on

a variety of plain media, or selective media such as Farrell's medium or Thayer-Martin's modified medium. Enrichment techniques can also be used. *B. canis* colonies are naturally rough (R) or mucoid (M). Repeated cultures may be necessary to detect *B. canis*.

Polymerase chain reaction (PCR) assays are available in some laboratories.

Samples to collect

***B. canis* is zoonotic; samples should be collected and handled with all appropriate precautions.**

Blood cultures are often used to detect *B. canis*. Bacteremia usually develops two to four weeks after infection, and can persist in some dogs for up to five years and possibly longer. Bacteremia can be intermittent. *B. canis* may also be found in semen, vaginal secretions, milk, urine, the placenta and aborted fetuses (gastric contents, liver, spleen). Recommended biopsy or necropsy samples include lymph nodes, prostate, epididymis, testis, uterus, spleen, liver and bone marrow. The lymph nodes and spleen are most likely to be positive in non-bacteremic dogs. *B. canis* may also be found in clinically affected vertebrae or the eyes. Samples for culture should be kept cold and transported to the laboratory as soon as possible.

Serum should be collected for serology.

Recommended actions if brucellosis is suspected

Notification of authorities

Canine brucellosis caused by *B. canis* is a reportable disease in some states. State authorities should be consulted for specific guidelines.

Federal: Area Veterinarians in Charge (AVIC):

www.aphis.usda.gov/animal_health/area_office.html

State Veterinarians:

www.aphis.usda.gov/vs/sregs/official.html

Control

Canine brucellosis is usually introduced into a kennel in an infected dog or semen. This disease is controlled by sanitation and the removal of infected dogs. Housing in individual cages reduces the spread of the organism. Repeated testing and the removal of seropositive or culture-positive animals, combined with quarantine and testing of newly added dogs, have been used to eradicate brucellosis from some kennels. There is no vaccine for *B. canis*.

Long-term antibiotic therapy has been used successfully to treat some dogs, but some animals relapse. Neutering can be used as an additional control measure.

Brucella species are readily killed by most commonly available disinfectants including hypochlorite solutions, 70% ethanol, isopropanol, iodophores, phenolic disinfectants, formaldehyde, glutaraldehyde and xylene; however, organic matter and low temperatures decrease the efficacy of disinfectants. Disinfectants reported to destroy *Brucella* on contaminated surfaces include 2.5% sodium hypochlorite, quaternary ammonium compounds, 2-3% caustic soda, 20% freshly slaked lime suspension, or 2% formaldehyde solution (all tested for one hour). Ethanol, isopropanol, iodophores, substituted phenols or diluted hypochlorite solutions can be used on contaminated skin; alkyl quaternary ammonium compounds are not recommended for this purpose. Autoclaving [moist heat of 121°C (250°F) for at least 15 minutes] can be used to destroy *Brucella* species on contaminated equipment. These organisms can also be inactivated by dry heat [320-338°F (160-170°C) for at least 1 hour]. Boiling for 10 minutes is usually effective for liquids. *Brucella* species can also be inactivated by gamma irradiation.

Public Health

B. canis is zoonotic, but the virulence of this organism for humans may be low. Approximately 30 cases have been reported worldwide since the 1960s. However, *B. canis* infections can be difficult to diagnose in humans and may be underreported. Seroprevalence rates reported in humans include 13% in a group of hospital patients in Mexico, 0.3% in Germany, 0.4% in US military populations, 0.6 % in Florida residents, and 67.8 % in Oklahoma residents. Human infections can occur after exposure to bacterial cultures in the laboratory or close contact with dogs, particular after an abortion. A laboratory worker exposed to the less virulent M-strain of *B. canis*, which is used as an antigen for serological testing, developed symptoms similar to those caused by wild-type strains of *Brucella*.

B. canis infections in humans resemble brucellosis caused by other *Brucella* species. Some people infected with *Brucella* remain asymptomatic. In symptomatic cases, brucellosis is extremely variable and the clinical signs may appear insidiously or abruptly. Typically, this disease begins as an acute febrile illness with nonspecific flu-like signs such as fever, headache, malaise, back pain, myalgia and generalized aches. Drenching sweats can occur, particularly at night. Oral lesions were reported in a child concurrently infected with *B. canis* and cytomegalovirus, and resolved with antibiotic treatment for brucellosis. Another patient with a *B. canis* infection had fever of unknown origin. Some patients with brucellosis recover spontaneously, while others develop persistent symptoms that typically wax and wane. Occasionally seen complications include arthritis, spondylitis, chronic fatigue, and epididymo-orchitis. Neurologic signs (including personality changes, meningitis, uveitis and optic neuritis), anemia, internal abscesses, nephritis, endocarditis and dermatitis can also occur. Other organs and tissues can also be affected, resulting in a wide variety of syndromes. Treatment is with antibiotics; however, relapses can be seen months after the initial symptoms, even in successfully treated cases. The mortality rate is low; in untreated persons, estimates of the case fatality rate vary from less than 2%

to 5%. Deaths are usually caused by endocarditis or meningitis.

Internet Resources

Centers for Disease Control and Prevention (CDC). Brucellosis. http://www.cdc.gov/ncidod/dbmd/diseaseinfo/brucellosis_t.htm

Food and Agriculture Organization of the United Nations. Manual for the Recognition of Exotic Diseases of Livestock, A Reference Guide for Animal Health Staff. http://www.spc.int/rahs/

Public Health Agency of Canada. Material Safety Data Sheets http://www.phac-aspc.gc.ca/msds-ftss/index.html

The Merck Manual http://www.merck.com/pubs/mmanual/

The Merck Veterinary Manual http://www.merckvetmanual.com/mvm/index.jsp

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*Link defunct as of 2007