



BRUCELLOSIS

Background

Brucellosis is an infectious disease caused by *Brucella* species such as *Brucella melitensis*, *Brucella abortus*, and *Brucella suis*. People can get the disease when they are in contact with infected animals or animal products contaminated with the bacteria. From 1993 through 2010, the number of brucellosis cases reported in the US ranged from 79 to 139, with an average of 109 cases per year. In 2010, the highest number (56.5%) of brucellosis cases was reported by California, Texas, Arizona, and Florida. Michigan reported four cases that same year (range=0-10 cases per year).

Signs and Symptoms

Acute

- Non-specific: fever, sweats, malaise, anorexia, headache, pain in muscles, joint, and/or back pain, fatigue
- Sub-clinical infections are common
- Lymphadenopathy (10–20%), splenomegaly (20–30%)

Chronic

- Recurrent fever
- Arthritis and spondylitis
- Swelling of the testicle and scrotum area
- Swelling of the heart (endocarditis)
- Swelling of the liver and/or spleen
- Neurologic symptoms (in up to 5% of all cases)
- Possible focal organ involvement
- Chronic fatigue
- Depression

Brucellosis in Pregnant Women

- Brucellosis during pregnancy carries the risk of causing spontaneous abortion, particularly during the first and second trimesters; therefore, women should receive prompt medical treatment with the proper antimicrobials.

Incubation Period

- Highly variable (5 days–6 months)
- Average onset 2–4 weeks

Transmission

Ingestion: The most common way to be infected is by eating or drinking unpasteurized/raw dairy products. When sheep, goats, cows, or camels are infected, their milk becomes contaminated with the bacteria. If milk from infected animals is not pasteurized, the infection will be transmitted to people who consume the milk and/or cheese products.

Inhalation: Breathing in the bacteria that causes brucellosis may also lead to infection. This risk is generally greater for people in laboratories that work with the bacteria. In addition, slaughterhouse and meat-packing employees have also been known to be exposed to the bacteria and ultimately become infected.

Skin Wound/Mucosal Membrane: Bacteria can also enter wounds in the skin/mucous membranes through contact with infected animals.



Person-to-person spread of brucellosis is extremely rare. Sexual transmission has been rarely reported. While uncommon, transmission may also occur via tissue transplantation or blood transfusions. While neonatal brucellosis cases are rare, infection may occur through transplacental transmission of *Brucella* spp. during a maternal bacteremic phase, from exposure to blood, urine, or vaginal secretions during delivery, or through breastfeeding.

Risk Factors

- Workers who have close contact with animals or animal excretions (newborn animals, fetuses, and excretions that may result from birth), such as slaughterhouse workers, meat-packing plant employees, veterinarians, or laboratory workers.
- People who hunt animals may be at risk when they are in contact with infected animals. Exposure to the bacteria may occur through skin wounds, ingesting undercooked meat, or inhaling the bacteria while dressing their game. Commonly infected animals include bison, elk, caribou, moose and wild hogs (feral swine).
- Although brucellosis can be found worldwide, it is more common in the following high risk areas: the Mediterranean Basin, Mexico, South and Central America, Eastern Europe, Asia, Africa, the Caribbean, and the Middle East.

Treatment

Before treatment begins, a diagnosis of brucellosis infection must be made by a doctor. Tests will be performed to look for bacteria in samples of blood, bone marrow, or other body fluids. In addition, a blood test can be performed to detect antibodies against the bacteria.

Once a diagnosis is made, a doctor can prescribe antibiotics. Depending on the timing of treatment and severity of illness, recovery may take a few weeks to several months. Death from brucellosis is rare, occurring in no more than 2% of all cases.

Generally, the antibiotics doxycycline and rifampin are recommended in combination for a minimum of 6-8 weeks. Let your doctor know if you are:

- pregnant
- allergic to doxycycline or rifampin
- suffer from a reduced or absent immune response (immunosuppressed)

Prevention

The best way to prevent brucellosis infection is to be sure you do not consume:

- undercooked meat
- unpasteurized dairy products, including milk, cheese, and ice cream

If you are not sure that the dairy product is pasteurized, do not eat it.

People who handle animal tissues (such as hunters and animal herdsman) should protect themselves by using rubber gloves, goggles, and gowns or aprons. This will help ensure that bacteria from potentially infected animals do not get into eyes or inside a cut or abrasion on the skin.

CDC/CSTE Laboratory Criteria for Diagnosis

Definitive

- Culture and identification of *Brucella* spp. from clinical specimens
- Evidence of a four-fold or greater rise in *Brucella* antibody titer between acute and convalescent phase serum specimens obtained greater than or equal to 2 weeks apart



Presumptive

- *Brucella* total antibody titer of greater than or equal to 1:160 by standard tube agglutination test (SAT) or
- *Brucella* microagglutination test (BMAT) in one or more serum specimens obtained after onset of symptoms
- Detection of *Brucella* DNA in a clinical specimen by PCR assay

Diagnostic Difficulties

While culture is the gold standard, *Brucella* spp. can be fastidious, slow growers. Culture from primary specimens may require up to 21 days of incubation. Bone marrow culture is more sensitive than blood; however, the invasiveness of the procedure should be considered. Persons with chronic infections are less likely to be culture-positive.

Agglutination is a confirmatory serological test to diagnose brucellosis. The standard tube agglutination test (SAT) is the reference method, of which BMAT is a modified format.

IgM detection sensitivities using other EIA formats are qualitative and limited, making them difficult to interpret in a clinical setting. These tests might have different performance characteristics and utility when used in areas with low disease prevalence, such as the United States. Results of EIA tests must be confirmed by a quantitative reference method such as BMAT.

Case Classification

Probable: A clinically compatible illness with at least one of the following:

- Epidemiologically linked to a confirmed human or animal brucellosis case
- Presumptive laboratory evidence, but without definitive laboratory evidence, of *Brucella* infection

Confirmed: A clinically compatible illness with definitive laboratory evidence of *Brucella* infection

Select Agent Designation

Select agents and toxins are a subset of biological agents and toxins that may pose a severe threat to public health. *Brucella* species are easily aerosolized and have a low infectious dose, cited at levels between 10 and 100 microorganisms. These organisms also have a prolonged incubation period with the potential to induce a broad range of clinical manifestations, and therefore generate challenges for prompt diagnosis. The above factors have contributed to a select agent designation for *Brucella suis*, *Brucella melitensis*, and *Brucella abortus*.

Recommendations for Lab Exposure Surveillance

- Determine number of workers exposed to *Brucella* isolates and classify exposures into high- and low-risk (using chart at <https://www.cdc.gov/brucellosis/laboratories/risk-level.html>)
- For high-risk exposures, recommend PEP:
 - doxycycline 100mg twice daily and rifampin 600mg once daily for 3 weeks
 - trimethoprim-sulfamethoxazole should be considered for those patients with contraindications to doxycycline
 - pregnant workers with high-risk exposures should consider PEP in consultation with their obstetricians
 - persons with contraindications to rifampin should consult with their health care provider for alternative PEP
- For low-risk exposures, consider PEP and discuss with affected workers
- Obtain baseline serum samples from all workers as soon as possible after a potential *Brucella* exposure is recognized. If available, obtain pre-exposure stored specimens



- Arrange for sequential serologic testing on all workers exposed to *Brucella* (e.g. 0, 6, 12, 18 and 24 weeks post exposure) using agglutination tests at state public health laboratory or CDC
- Arrange for regular (e.g. weekly) symptom watch and daily self-fever checks for persons with high- and low-risk exposures for 6 months following last exposure

Recommendations for *Brucella canis* Exposure from Infected Dogs

While dogs can become infected with various *Brucella* spp., they serve as the primary host for *Brucella canis*. *B. canis* is thought to be less virulent than other strains of *Brucella* species and few human cases have been documented, though this may be a result of difficulty in diagnosis and underreporting.

- **Symptom Monitoring:** Symptom monitoring should be emphasized following exposures to dogs infected with brucellosis because of the lack of serological tests available to identify seroconversion. The symptom monitoring table found in Appendix 2 of the [Brucellosis Reference Guide](#) can be given to exposed individuals.
- **Serological Monitoring:** While serological monitoring is not available for *B. canis* exposures, it is recommended that baseline serum be drawn for serological testing to rule out titers to other *Brucella* spp., as veterinary personnel may be exposed to a variety of species.
- **Antimicrobial Post-Exposure Prophylaxis (PEP):** A prophylaxis regimen should be considered for all personnel with high-risk exposures. See Table 4 in the [Brucellosis Reference Guide](#) for PEP guidance.

Additional information about *B. canis* and human infections can be found in the National Association of State Public Health Veterinarians Summary Findings and Recommendations from 2012 on Public Health Implications of *Brucella canis* Infections in Humans.

(<http://www.nasphv.org/Documents/BrucellaCanisInHumans.pdf>)

Resources

- Brucellosis Reference Guide: Exposures, Testing, and Prevention. February 2017 Edition. Centers for Disease Control and Prevention. <https://www.cdc.gov/brucellosis/pdf/brucellosis-reference-guide.pdf>
- CDC Brucellosis Website: <https://www.cdc.gov/brucellosis/index.html>
- CDC/CSTE Case Definition: <https://www.cdc.gov/nndss/conditions/brucellosis/>
- Public Health Implications of *Brucella canis* Infections in Humans. March 2012. National Association of State Public Health Veterinarians. <http://www.nasphv.org/Documents/BrucellaCanisInHumans.pdf>