Leptospirosis

Leptospirosis, also known as Weils Disease, Pretibial (Fort Bragg) Fever, Swineherd's Disease, Swamp Fever, Mud Fever, Hemorrhagic Jaundice, and Canicola Fever is a bacterial disease caused by the genus *Leptospira*[1-9]. Leptospirosis is distributed worldwide and is endemic in tropical areas. It has caused epidemics in urban areas where sanitation conditions favor rodent-borne transmission[1,2,3,7,8,9]. Outbreaks of leptospirosis in the U.S. are usually caused by exposure to contaminated water, such as floodwaters and recreational waters. In Arizona, there are typically 0 to 1 cases of leptospirosis each year and have typically been associated with travel to endemic areas[1,2,3,7,8,9].

A. Agent:
Leptospires are long, thin, motile spirochetes of the species *Leptospira interrogans*. More than 200 pathogenic serovars have been identified. Serovars are further divided into 25 serogroups based on DNA relatedness[1,2,3,7,8,9].

B. Clinical Description:
Those who have symptoms typically experience flu-like illness including fever, headache (can be severe and include retro orbital pain and photophobia), myalgia (especially calves and lower back), conjunctivitis without purulent discharge, nausea/vomiting, diarrhea, cough, abdominal pain, and a rash (rare) [1,2,3,7,8,9]. Severe disease occurs in up to 10% of symptomatic persons and can involve renal and hepatic failure, meningitis, and/or respiratory distress. Approximately 5–15% of severe cases are fatal[1,2,3,7,8,9]. However, the majority of people who are infected with leptospirosis are asymptomatic[1,2,3,7,8,9]. Clinical course is highly variable. The serious icteric form (Weil's disease) is uncommon, but hemorrhage, hepatomegaly, pulmonary hemorrhage, ARDS, and jaundice are among the severe features[1,2,3,7,8,9].

C. Reservoirs:
Rats, mice, and moles are important primary hosts, but a wide range of other mammals including dogs, deer, rabbits, hedgehogs, cows, sheep, raccoons, opossums, skunks, and certain marine mammals are able to carry and transmit the disease as secondary hosts[1,2,3,7,8,9]. The types of habitats most likely to carry infective bacteria from wildlife are muddy riverbanks, ditches, gullies, and muddy livestock rearing areas where there is regular passage of either wild or farm mammals[1,2,3,7,8,9]. Domestic animals can become infected in areas where animals congregate (such as dog parks and dog boarding facilities) [1,2,3,7,8,9].

D. Mode of Transmission:
Leptospirosis is transmitted by the urine of infected animals and can survive there for weeks to months[1,2,3,7,8,9]. Humans can also become infected through contact with water, food, bedding, or soil containing urine (or other body fluids such as birthing fluids, except saliva) from these infected animals[1,2,3,7,8,9]. This may happen by swallowing contaminated food or water, or through skin contact, such as through recreational water exposure[1,2,3,7,8,9]. Persons who work outdoors, or with animals (i.e., farmers, mine workers, sewer workers, slaughterhouse workers, veterinarians and animal caretakers, fish workers, dairy farmers, and military personnel) are at risk of exposure. Person-to-person transmission is rare[1,2,3,7,8,9].

The bacteria can be shed intermittently in the urine of infected dogs, including those that are not showing signs of being sick[1,2,3,7,8,9]. It can be spread from dog to dog and, rarely, to

people[1,2,3,7,8,9, 13, 14, 15]. The bacteria can be present in a dog's urine for several months after recovery from illness if not properly treated with antibiotics. The shedding period can be shorter if the dog is treated with antibiotics[1,2,3,7,8,9].

E. Incubation Period:
Usually ten days, with a range of 2–30 days[1,2,3,7,8,9].

F. Period of Communicability:
Person-to-person is rare[1,2,3,7,8,9].

G. Susceptibility and Resistance:
All persons are susceptible. Reinfection has occurred after treatment. Serovar-specific immunity follows infection; however this does not protect against infection with different serovars[1,2,3,7,8,9].

H. Treatment:
Leptospirosis infection is treated with antibiotics, such as doxycycline (oral) or penicillin (IV), which should be given early in the course of the disease[1,2,3,7,8,9]. Exposed persons do not need to take antibiotics unless they are showing symptoms.

Disease Management

I. Clinical Case Definition[10]:
Clinical presentation includes history of fever within the past two weeks and at least two of the following clinical findings: myalgia, headache, jaundice, conjunctival suffusion without purulent discharge, or rash (i.e. maculopapular or petechial); **OR** at least one of the following clinical findings[10]:

- Aseptic meningitis
- Gastrointestinal symptoms (e.g., abdominal pain, nausea, vomiting, diarrhea)
- Pulmonary complications (e.g., cough, breathlessness, hemoptysis)
- Cardiac arrhythmias, ECG abnormalities
- Renal insufficiency (e.g., anuria, oliguria)
- Hemorrhage (e.g., intestinal, pulmonary, hematuria, hematemesis)
- Jaundice with acute renal failure

J. Laboratory Criteria for Diagnosis[10]:
Confirmatory Testing

- Isolation of *Leptospira* from a clinical specimen, **OR**
- Fourfold or greater increase in *Leptospira* agglutination titer between acute and convalescent-phase serum specimens obtained >2 weeks apart and studied at the same laboratory, **OR**
- Demonstration of *Leptospira* in a clinical specimen by immunofluorescence, **OR**
- *Leptospira* agglutination titer of ≥800 by Microscopic Agglutination Test (MAT) in one or more serum specimens, **OR**
- Detection of pathogenic *Leptospira* DNA (e.g., by PCR) from a clinical specimen.

Presumptive Testing

- *Leptospira* agglutination titer of ≥200 but <800 by Microscopic Agglutination Test (MAT) in one or more serum specimens, **OR**
- Demonstration of anti-*Leptospira* antibodies in a clinical specimen by indirect immunofluorescence, **OR**

- Demonstration of *Leptospira* in a clinical specimen by darkfield microscopy, **OR**
- Detection of IgM antibodies against *Leptospira* in an acute phase serum specimen.

Case Classification[10]	
Confirmed	A clinically compatible case that meets the confirmatory laboratory criteria.
Probable	A clinically compatible case with at least one of the following: ● Involvement in an exposure event (e.g., adventure race, triathlon, flooding) with known associated cases, or ● Travel to an area where leptospirosis is endemic, or ● Exposure to a leptospirosis-positive animal (dog, livestock, etc.), or ● Presumptive laboratory findings, but without confirmatory laboratory evidence of *Leptospira* infection.

K. Classification of Import Status*:*
If the case is thought to have been exposed in Mexico or Canada, mark as bi-national in MEDSIS.

L. Laboratory Testing:
Diagnostic testing should be requested for patients in whom there is a high index of suspicion for leptospirosis, based either on signs and symptoms, or on occupational, recreational, or vocational exposure to animals or environments contaminated with animal urine.

Arizona State Public Health Laboratory (ASPHL) does not perform *Leptospira* testing. All specimens that meet clinical and epidemiologic criteria (e.g. high risk occupation, recreational water exposure, etc.) are forwarded to CDC for testing.

Specimen Requirements	
Specimen Collection	Venipuncture
Sample Type	Serum
Amount required	10 mL whole blood
Preferred Specimen	Paired Sera
Storage Instructions	Do not freeze or refrigerate whole blood. Separated serum may be held at 2-8°C.
Causes for Rejection	Discrepancy between name on the tube and name on form, insufficient quantity of serum for testing.
Sample Container	Red top or tiger top tube
Diagnostic Information	Prior notification of ADHS epidemiologist is requested: call 602-364-3676 or e-mail vbzd@azdhs.gov. A detailed patient history is required. Sera are sent to ASPHL and then forwarded to the CDC.

M. Assessing Laboratory Results:
All *Leptospira* cultures are forwarded to CDC. Positive cultures should be reported to the ADHS Bureau of Epidemiology and Disease Control.

N. Outbreak Definition:

- Diagnosis or detection of two or more cases of leptospirosis from different households and families after exposure to a common source.
  or
- An unexplained, unexpected increase in cases of leptospirosis that is clustered by time, place, or person.

Investigation Guidelines

O. Time Frame:

Report within 5 working days in which the case or suspected case presents and/or a positive laboratory result to the local public health department where the patient resides. Report all confirmed, probable, and suspect cases to ADHS Office of Infectious Disease Epidemiology Section, within 5 working days of the initial report. ADHS will notify the appropriate animal health partners if the patient reports exposure to animals.

P. Forms:

- ADHS Leptospirosis Case Investigation Report Form available at: https://www.azdhs.gov/preparedness/epidemiology-disease-control/index.php#investigations-forms

Q. Investigation Steps:

- **Confirm Diagnosis**
  i. Before contacting the patient or family, determine what information is available from medical records, physician, etc.
  ii. Obtain information that supports clinical findings:
    - Demographic data (birth date, county, sex, race/ethnicity), date of onset of each symptom, occupation, hospitalizations, complications, and outcome status (survived or date of death).
  iii. Obtain information on any laboratory tests performed and results or date results are expected.

- **Conduct Case Investigation**
  Epidemiological investigation report should be submitted in MEDSIS by filling out the full Disease Specific Observation (DSO) and Travel Table.

  Interview case to determine source, risk factors, and transmission settings[1,2,3,4,7,8,9,10].
  - Collect dates of exposure to contaminated water, location of possible exposure, domestic and wild animal contact – including types and dates, contact information of other potentially exposed people, and any other pertinent information.

- **Conduct Contact Investigation**
  Contacts should be alerted to the symptoms in case they have a history of exposure to infected animals or contaminated waters by virtue of being in one of the high-risk occupations or by similar exposure as the case. If exposure occurred to an infected animal such as a dog that had been diagnosed with leptospirosis, the veterinary clinic must be contacted and any other facilities such as dog daycare or boarding facilities to follow-up with potentially exposed staff and to provide education about the zoonotic potential of

leptospirosis and inquire about symptoms. Other family members in the household where the dog lives should also be followed up with.

- **Initiate Control and Prevention Measures** [1,2,3,7,8,9, 10, 13, 14, 15]
  Public education about symptoms, the mode of transmission, and prevention of the spread of disease from animals to people (if applicable) should be considered.
  Specific recommendations should be provided if related to canine leptospirosis as follows:

  - Prevention and infection control at veterinary clinics[1,2,3,7,8,9, 10, 13, 14, 15]
    - Avoid contact with urine from infected dogs
    - Wear protective equipment such as gloves, face shield or mask, and gown when caring for ill dogs or cleaning up their urine or other body fluids
    - Wash hands with soap and water after interacting with patients or cleaning up their urine/body fluids
    - House infected dogs away from high-traffic areas and minimize the dog's movement around the hospital
    - Walk infected animals in a designated and easy to clean area away from other dogs
    - Use 1:10 (1 part bleach and 9 parts water) solution to clean areas where infected dogs are housed, where they have urinated or other areas contaminated by body fluids
    - Normal laundering of urine-contaminated bedding and towels will inactivate the bacteria
    - Avoid aerosolization of bacteria through activities such as pressure washing runs where dogs are housed
    - Pregnant or immunocompromised individuals should avoid contact with potentially infected dogs and their urine
    - Notify public health if staff that have been caring for infected dogs develop signs of illness
    - Start infection control procedures for any dog suspected of having leptospirosis (while awaiting laboratory confirmation)

  - Prevention and infection control guidance for dog owners[13, 14, 15]
    - Leptospirosis can be spread from dogs to people, and they should visit their doctor if they become sick
    - Give clear instructions to the owners for continuing the full course of antibiotics at home
    - Explain that the bacteria may be present in the urine for up to a few months after infection and how to protect themselves from exposure
    - Recommend that owners avoid taking their dog to dog parks, daycare, or boarding facilities until 6 weeks after the dog has finished antibiotics
    - If the owner cannot keep their dog at home, the boarding facility or daycare should be notified that the dog has recently been diagnosed with leptospirosis

- Encourage annual vaccination against leptospirosis for all dogs (the vaccine does not have a higher likelihood of causing vaccine reactions than any other vaccine)
- Always wash your hands after coming in contact with sick dogs and their urine or body fluids.
- Wear gloves while cleaning up after your dog to avoid contact with their urine.
- Use a household antibacterial cleaning solution to clean up areas in your home if your dog urinates inside (such as a 1:10 bleach solution - 1 part bleach, 9 parts water). Urine-contaminated bedding and towels are disinfected through normal laundering.
- Designate an area for your dog to urinate that is away from areas where other people or dogs frequently go and away from areas of standing water.

- Recommendations for Staff at Dog Boarding/Daycare Facilities[13, 14, 15]
  - Infected dogs should be placed in floor-level cages, if possible, and housed away from high-traffic areas to limit urine-contamination.
  - Kennels should be clearly marked with warning label to alert people to the presence of a leptospirosis positive dog.
  - Pregnant or immunocompromised staff should avoid contact with infected dogs.
  - Staff should wear gloves when handling an infected dog, and additional protective equipment such as a face shield and a gown when cleaning up the dog's urine.
  - Staff should wash their hands after handling an infected dog, the dog's urine, or anything that may have been contaminated by the dog's urine.
  - Avoid pressure-washing areas where infected dogs are housed, to avoid aerosolization of bacteria.
  - Infected dogs should be walked in a designated and easy to clean area, with hard, non-permeable surfaces, away from other dogs.
  - Disinfectants, such as a 1:10 bleach solution (1 part bleach, 9 parts water), should be used to clean areas where infected dogs are housed and where they have urinated.
  - Normal laundering of urine-contaminated bedding and towels will inactivate the bacteria.
  - Ask owners if their dog has been recently ill or been previously vaccinated against leptospirosis.
  - Notify public health if staff that have been caring for infected dogs develop signs of illness.

- **Case Management**[1,2,3,7,8,9,]
  Cases should be followed to determine outcome of illness and facilitate additional leptospirosis testing as needed.

- **Contact Management, Including Susceptible Contacts**[1,2,3,7,8,9]
  Diagnostic testing and antibiotic prophylaxis is not currently recommended for asymptomatic individuals.

Contacts and other potentially exposed persons should be monitored for 30 days for symptoms and told to visit their healthcare provider and contact local public health if they develop symptoms

- **Notifications**
  If a source of contaminated water is identified, the relevant agencies (e.g. EHS, Park Services, etc.) should be notified.
  If a leptospirosis-positive animal is identified, the relevant agencies (e.g. Department of Agriculture, USDA, etc.) should be notified..

R. Outbreak Guidelines:

There are no formal outbreak definitions; however, the investigator may consider the possibility of an outbreak when there is an unusual clustering of cases in time and/or space. In the event of an outbreak in animals, a serosurvey or exposure questionnaire can be considered for people who were exposed to infected animals. Enhanced surveillance for leptospirosis in rodents and other potential wildlife reservoirs can also be considered.

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