Tick-borne Disease, Excluding Lyme and Relapsing Fever

(Babesiosis, Ehrlichiosis and Anaplasmosis, Tick Paralysis, Spotted Fever Rickettsiosis)

Signs and Symptoms	• Vary from asymptomatic to severe disease. Except in tick paralysis, symptoms often include fever, headache, myalgia, nausea; other symptoms vary according to agent. • Babesiosis: splenomegaly, hepatomegaly, or jaundice may also be seen. • Spotted fever rickettsioses: eschars generally precede fever; rash and lymphadenopathy can be indicative. • Tick paralysis: acute, ascending, flaccid paralysis. Possible fatigue, myalgia, leg numbness. Paralysis may affect breathing muscles and cause respiratory failure.
Incubation	Varies with agent; babesiosis can present after weeks or months, and may recur
Case classification	Differs for each disease. See Section 3. • Babesiois • Ehrlichiosis and Anaplasmosis • Rickettsiosis • Tick paralysis
Differential diagnosis	Except for tick paralysis, difficult to distinguish clinically due to overlap of symptoms; cross-reactivity and persistent IgM within etiologic agent groups may occur. Generally include: Lyme disease, malaria, bacterial or viral meningitis, other rare tick-borne agents (STARI, neorickettsia, tularemia, etc.), typhoid fever.
Treatment	For Rocky Mountain Spotted Fever (RMSF), prompt diagnosis and treatment (with doxycycline) critical for preventing severe disease. Tick paralysis is treated by tick removal. Others are treated with antibiotics (in combination with anti-parasite drugs for babesiosis).
Duration	Varies with agent.
Exposure	Vector: ticks. Not person-to-person communicable, except for babesiosis and anaplasmosis/ehrlichiosis via blood transfusion or organ donation.
Laboratory testing	Local health jurisdiction (LHJ) and Communicable Disease Epidemiology (CDE) can arrange testing • Best specimens: generally whole blood collected pre-treatment, blood smears, serum, biopsied skin or tissue • Keep whole blood or serum **cold or if already frozen keep frozen (dry ice), ship** with Serology form: https://www.medialab.com/dv/dl.aspx?d=1615463&dh=e4b87&u=69790&uh=0e2a1 Specimen Collection and Submission Instructions: https://www.doh.wa.gov/ForPublicHealthandHealthcareProviders / PublicHealthLaboratories/MicrobiologyLabTestMenu
Public health actions	LHJ can consult with CDE 877-539-4344 for testing • Confirm diagnosis – confirmatory testing may be needed • Identify potential exposures, particularly local • Notify CDE promptly for locally acquired cases (e.g., no out-of-state travel) • Babesiosis cases must defer from blood donation for life. *Infection Control:* standard precautions

Tick-borne Disease, Excluding Lyme and Relapsing Fever

(Babesiosis, Ehrlichiosis and Anaplasmosis, Tick Paralysis, Spotted Fever Rickettsiosis)

1. DISEASE REPORTING

A. Purpose of Reporting and Surveillance

1. To distinguish tick-borne disease infections acquired locally from those related to travel.
2. To understand the epidemiology of tick-borne diseases in Washington State in order to inform public health and healthcare organizations about conditions that have been diagnosed in residents and to target education and control measures.
3. To identify emerging tick-borne diseases in Washington
4. To identify common sources of exposure or risks to the blood supply.

B. Legal Reporting Requirements

1. Healthcare providers and Healthcare facilities: notifiable to **local health jurisdiction** within 2 business days.
2. Laboratories: notifiable to **local health jurisdiction** within 2 business days. Submission on request - specimen associated with positive result, if available, within 2 business days.
3. Veterinarians: suspected human cases notifiable to local health jurisdiction within 24 hours.
4. Local health jurisdictions: notifiable to Washington State Department of Health (DOH) Communicable Disease Epidemiology (CDE) within 7 days of case investigation completion or summary information required within 21 days.

C. Local Health Jurisdiction Investigation Responsibilities

1. Consult CDE about suspected endemically acquired cases or for assistance with testing.
2. Facilitate transport of specimens to the Washington State Public Health Laboratories (PHL) if initial testing or confirmatory testing is needed. Please call CDE prior to submitting specimens (206-418-5500).
3. Report any case to CDE through the Washington Disease Reporting System (WDRS) as a Tick-borne Disease, including species or organism. Complete the tick-borne disease case report form (https://www.doh.wa.gov/Portals/1/Documents/5100/420-214-ReportForm-Tickborne.pdf) and enter the data into WDRS.

2. THE DISEASES AND THEIR EPIDEMIOLOGY

For information about Lyme disease and relapsing fever, see disease-specific guidelines at:

https://www.doh.wa.gov/Portals/1/Documents/5100/420-061-Guideline-Lyme.pdf

https://www.doh.wa.gov/Portals/1/Documents/5100/420-075-Guideline-RelapsingFever.pdf

Background

Tick-borne diseases are generally maintained in enzootic cycles involving tick vectors and mammal reservoirs. Agents include viruses, bacteria, and protozoan parasites. Only some species of ticks bite and transmit disease to people. Different species of ticks transmit different agents, but some may harbor multiple disease agents and simultaneous infections with multiple agents can occur.

Tick-borne diseases include Lyme disease (discussed separately), babesiosis, anaplasmosis, ehrlichiosis, rickettsioses, relapsing fever (discussed separately), tick paralysis, and other less common infections. Less common infections that are not included on the tick-borne diseases form (e.g., *Borrelia miyamotoi* or *B. mayonii* infection) should be reported under the condition "Rare Diseases of Public Health Significance."

All tick-borne diseases included in this guideline were previously collected using the "Rare Diseases of Public Health Significance" form, and historical surveillance reports are summarized under this category in the Washington State Annual Communicable Disease Report:
https://www.doh.wa.gov/DataandStatisticalReports/DiseasesandChronicConditions/CommunicableDiseaseSurveillanceData/AnnualCDSurveillanceReports.aspx

A. Etiological Agent

See Table 1 for a list of the tick-borne agents reviewed in this guideline.

B. Description of Illness

See Table 1 for a summary of symptoms for each disease. Early symptoms associated with anaplasmosis, babesiosis, ehrlichiosis, and spotted fever rickettsioses are non-specific and generally include fever, headache, myalgia, and nausea.

C. Tick-borne Diseases in Washington State

In contrast to Lyme disease, relapsing fever, and tularemia, for which locally acquired cases are reported each year, other tick-borne diseases are rare or have not been reported in Washington. No in-state acquired cases of anaplasmosis or ehrlichiosis have been reported in Washington residents; however, very low levels of *Anaplasma phagocytophliu*m have been found in *Ixodes* ticks collected from Washington. From 2004-2018, six cases of anaplasmosis were reported, all with out-of-state travel. One ehrlichiosis case was reported in 2011 following travel to an endemic area.

From 1990 to 2018, 14 babesiosis cases were reported, four with exposure in Washington. Of these four locally-acquired cases, three were caused by *B. duncani* and one was caused by *B. divergens*-like organism. The other babesiosis cases were associated with travel out-of-state or blood donation from an out-of-state donor, and were

confirmed or presumed to be caused by *B. microti*. To-date, tick surveillance has not identified *Babesia*-positive ticks in Washington.

Rocky Mountain spotted fever (RMSF, caused by *Rickettsia rickettsii*) was reported each year through the 1940s, after which reporting decreased to 0-4 cases per year. During 2004-2018, 16 cases were reported. Three of these cases were reported as locally acquired in 2011; however, none of these cases were confirmed and each had a single low-titer serology positive result. To-date, tick surveillance has not identified *R. rickettsia*-positive ticks in Washington. Other spotted fever rickettsioses cases are reported in international travelers, including Mediterranean spotted fever (*R. conorii*) and African tick bite fever (*R. africae*).

Washington has 0-2 cases of tick paralysis reported each year, with exposures mostly in eastern Washington.

D. Vectors and Reservoirs

See Table 1 for a list of the geographical distributions and reservoirs of the relevant tick vectors. Washington has several species of ticks capable of vectoring diseases to humans including *Ixodes pacificus* (western black-legged tick), *Dermacentor andersoni* (Rocky Mountain wood tick), *D. variabilis* (American dog tick), and *Ornithodorus hermsi* (soft tick).

Most ticks have four life stages: egg, larva, nymph, and adult. After hatching from the eggs, ticks must consume a blood meal at every stage to survive. Ticks that pick up disease agents from a reservoir host may spread disease to the next host, and vertical transmission of some etiologic agents (*Babesia spp., Rickettsia spp.*) has been demonstrated in many tick species.

Disease is usually spread by ticks in the nymphal stage and by adult females. Nymphs are mostly found in areas with woods, brush, or grass, and are easily overlooked due to their small size. Disease prevalence is highest during the warm months of spring and summer, coinciding with the period of highest nymph activity, but tick-borne diseases can occur at any time.

Animal hosts to hard ticks include dogs, opossums, lagomorphs, rodents, with clinical illness in dogs and some rodents.

E. Modes of Transmission

Tick-borne diseases are most commonly transmitted by inoculation from a tick bite. Most bites are painless and humans may not know they were bitten.

Ehrlichiosis, tick paralysis, and spotted fever rickettsioses are not known to be transmitted between persons. Transmission of anaplasmosis has been reported through blood donated from acutely infected donors.

Babesiosis is communicable via blood transfusion or from mother to infant during pregnancy or delivery.

F. Incubation Period

Varies with agent. See Table 1.

G. Period of Communicability

Not applicable for ehrlichiosis, tick paralysis, or spotted fever rickettsioses. Unknown for anaplasmosis. Babesiosis cases must defer from blood donation for life. No tests have yet been licensed for screening U.S. blood donors for babesiosis.

H. Treatment

Early diagnosis in the clinical course is critical to limit progression to severe disease and because this is the period when antibiotics are most effective. Except for tick paralysis, tick-borne diseases are treated with antibiotics, or a combination of antibiotics and anti-parasite drugs (babesiosis). Doxycycline is the first line treatment for rickettsial infections including anaplasmosis, ehrlichiosis, and spotted fever rickettsioses in adults and children of all ages, and should be initiated immediately whenever disease is suspected. Failure to respond to doxycycline suggests that the patient's condition might not be caused by rickettsial infection.

The treatment for tick paralysis is simply removal of the tick. This usually results in complete recovery within 24 hours.

Table 1. Geographic Distribution and Clinical Characteristics of Selected Tick-borne Diseases[1]

Disease (Etiologic agent)	Vector Tick Species	Geographic Distribution of Ticks	Animal Reservoirs[2]	Incubation period	Common symptoms
Anaplasmosis (*Anaplasma phagocytophilum*)	• Blacklegged tick (deer tick, *Ixodes scapularis)* • Western blacklegged tick *(Ixodes pacificus)*	• Upper Midwest & Northeastern US (*I. scapularis*) • US West coast (*I. pacificus*)	Wild rodents, cervids, ruminants, dogs	Generally 1-2 weeks (5-21 days)	Fever, headache, myalgia, malaise, nausea, abdominal pain, cough, confusion, (rash rare).
Babesiosis (*Babesia microti, B. duncani, other rare Babesia spp.*)	Blacklegged tick (deer tick, *Ixodes scapularis)* *Ixodes albipictus* for *B. duncani*	Upper Midwest (WI, MN) & Northeastern US. Sporadic on US West coast.	mice, voles, raccoons, deer	Variable, 1-9+ wks, possibly months. May recur.	Fever, headache, sweats, myalgia, arthralgia, malaise, fatigue, GI symptoms, splenomegaly, hepatomegaly, hemolytic anemia, jaundice.
Ehrlichiosis (*Ehrlichia chaffeensis*, *E. ewingii, E. muris)*	Lone Star tick (*Amblyomma americanum*) (Unknown for *E. muris*)	Southeastern & Central US	Deer, dogs, rodents, ruminants	5-14 days	Fever, headache, myalgia, malaise. Nausea/vomiting/diarrhea, conjunctivitis, confusion. Rash (≤ 60% of children, ≤ 30% of adults).
Tick paralysis (Tick toxin)	• American dog tick *(Dermacentor variabilis)* • Rocky Mountain wood tick *(Dermacentor andersoni)* • Also seen with at least 43 tick species worldwide	• Southeastern US • Northwestern US, Western Canada	n/a	4-7 days (while tick feeds)	Acute, ascending, flaccid paralysis. Possible fatigue, myalgia, numbness in the legs, and in children, flu-like symptoms. Paralysis may affect breathing muscles and cause respiratory failure.
STARI (Cause unknown)	Lone Star tick (*Amblyomma americanum*)	Southeastern & Central US	Unknown	6-7 days	Erythema migrans rash, fatigue, fever, headache, myalgia

Spotted Fever Rickettsioses (spotted fevers)					
Rocky Mountain Spotted Fever (RMSF, *Rickettsia. rickettsii*)	• American dog tick *(Dermacentor variabilis)* • Rocky Mountain wood tick *(Dermacentor andersoni)* • Brown dog tick *(Rhipicephalus sanguineus)*	• East of the US Rocky Mountains, US Pacific Coast *(D. variabilis)* • US Rocky Mountain states, SW Canada *(D. andersoni)* • Transmits in SW US & US-Mexico border. *(R. sanguineus)*	Rodents	2-14 days (avg: 1 wk)	Acute onset fever, headache, myalgia, malaise, nausea/vomiting, stomach pain, anorexia, photophobia, focal neurologic deficits. Maculopapular rash 2-4 days (90% of patients), petechial rash 5+ days after fever onset.
Rickettsia parkeri Rickettsiosis (*R. parkeri*)	Gulf Coast tick *(Amblyomma maculatum)*	Southeastern US	Rodents	A few days- 1 week	Eschar, followed by fever, headache, myalgia, regional lymphadenopathy, rash.
Pacific Coast Tick Fever (*R. philipii*)	Pacific Coast tick *(Dermacentor occidentalis)*	Western US coastline (CA, OR, WA)	Possibly jackrabbits, deer	A few days-1 week	Eschar, followed by fever, headache, myalgia, fatigue, lymphadenopathy, rash (less common).
Mediterranean Spotted Fever (*R. conorii*)	None in U.S.	Southern Europe, southern and western Asia, Africa, India	Dogs, rodents	1-2 weeks	Rash, fever, eschar
African Tick Bite Fever (*R. africae*)	None in U.S.	Sub-Saharan Africa, West Indes	Ruminants	1-2 weeks	Fever, headache, myalgia, eschar

[1]Viral diseases caused by ticks (Colorado tick fever, Powassan) are listed in Table 1 of the arboviral disease guideline https://www.doh.wa.gov/Portals/1/Documents/5100/420-046-Guideline-Arbo.pdf

[2]Many tick species are disease reservoirs. Below adapted in part from https://wwwnc.cdc.gov/travel/yellowbook/2020/travel-related-infectious-diseases/rickettsial-including-spotted-fever-and-typhus-fever-rickettsioses-scrub-typhus-anaplasmosis-and-ehr

3. CASE DEFINITIONS

NOTE: - Lyme disease and **relapsing fever** are discussed **in separate guidelines**.

A. Babesiosis

1. Background & Epidemiology

Babesiosis is a parasitic disease caused by intraerythrocytic parasites of the *Babesia* genus, most commonly *B. microti* but also *B. duncani* (formerly WA1), which was first described in Washington State, and *B. divergens*-like agents identified in the United States. Babesia are most commonly transmitted through bites of infected ticks, but can also be acquired through contaminated blood components from asymptomatic parasitemic donors or, more rarely, transplacentally. See Table 1 for information on vector tick distribution.

2. Clinical Description

Clinical disease ranges in severity from asymptomatic to life-threatening and can include hemolytic anemia and nonspecific influenza-like signs and symptoms. Splenomegaly, hepatomegaly, or jaundice may be evident. In addition, laboratory findings may also include thrombocytopenia, proteinuria, hemoglobinuria, and elevated levels of liver

enzymes, blood urea nitrogen, and creatinine. Persons who are elderly, asplenic, or immune compromised are at risk for severe illness. Severe cases can be associated with marked thrombocytopenia, disseminated intravascular coagulation, hemodynamic instability, acute respiratory distress, myocardial infarction, renal failure, hepatic compromise, altered mental status, and death. Differential diagnoses: ehrlichiosis, Lyme disease, relapse of malaria, spotted fevers, typhoid fever.

3. Clinical Criteria (2011)

For the purposes of surveillance, a clinically compatible case is defined as follows:

- Objective: one or more of the following: fever, anemia, or thrombocytopenia.
- Subjective: one or more of the following: chills, sweats, headache, myalgia, or arthralgia.

4. Laboratory Criteria for Diagnosis (2011)

For the purposes of surveillance, laboratory evidence includes:

Confirmatory:

- Identification of intraerythrocytic *Babesia* organisms by light microscopy in a Giemsa, Wright, or Wright-Giemsa–stained blood smear; **OR**
- Detection of *B. microti* DNA in a whole blood specimen by polymerase chain reaction (PCR); **OR**
- Detection of *Babesia spp.* genomic sequences in a whole blood specimen by nucleic acid amplification; **OR**
- Isolation of *Babesia* organisms from a whole blood specimen by animal inoculation.

Supportive:

- Demonstration of a *B. microti* IFA* total Ig or IgG antibody titer of ≥ 1:256 (or ≥1:64 in epidemiologically linked blood donors or recipients); **OR**
- Demonstration of a *B. microti* Immunoblot IgG positive result; **OR**
- Demonstration of a *B. divergens* IFA total Ig or IgG antibody titer of ≥ 1:256; **OR**
- Demonstration of a *B. duncani* IFA total Ig or IgG antibody titer of ≥ 1:512.

*IFA = indirect fluorescent antibody

5. Epidemiologic Linkage as evidence for transfusion transmission (2011)

For the purposes of surveillance: epidemiologic linkage between a transfusion recipient and a blood donor is demonstrated if all of the following criteria are met:

In the transfusion recipient:

- Received ≥ one red blood cell (RBC) or platelet transfusion within one year before the collection date of a specimen with laboratory evidence of *Babesia* infection; **AND**

- At least one of these transfused blood components was donated by the donor described below; **AND**
- Transfusion-associated infection is considered at least as plausible as tick-borne transmission; **AND**

In the blood donor:

- Donated at least one of the RBC or platelet components that was transfused into the above recipient; **AND**
- The plausibility that this blood component was the source of infection in the recipient is considered equal to or greater than that of blood from other involved donors. (More than one plausible donor may be linked to the same recipient.)

6. Case Classification (2011)

Suspected:

- A case that has confirmatory or supportive laboratory results, but insufficient clinical or epidemiologic information for case classification (e.g., only a laboratory report).

Probable:

- A case with supportive laboratory results and meets at least one of the objective clinical evidence criteria; **OR**
- A blood donor or recipient epidemiologically linked to a confirmed or probable babesiosis case (as defined above) **AND either**:
  - has confirmatory laboratory evidence but does not meet any objective or subjective clinical evidence criteria; **OR**
  - has supportive laboratory evidence but does not meet any objective clinical evidence criteria; (may meet subjective clinical evidence criteria)

Confirmed:

- A case with confirmatory laboratory results and meets ≥ one of the objective or subjective clinical evidence criteria, regardless of the mode of transmission.

7. Comments on Interpreting Babesiosis Laboratory Results

Diagnosis of babesiosis requires a high index of suspicion, in part because the clinical manifestations are nonspecific. The validity of the diagnosis of babesiosis is highly dependent on the laboratory that performs the testing. *Babesia* and *Plasmodium* (especially *P. falciparum*) parasites can be difficult to differentiate. Confirmation of the diagnosis by a reference laboratory is strongly encouraged, especially for patients without residence in or travel to areas known to have high incidence of babesiosis. A positive IFA result for IgM is insufficient for diagnosis in the absence of a positive IFA result for IgG or total Ig. If the IgM result is positive but the IgG result is negative, a follow-up specimen collected >1 week after the first should be tested.

8. Resources: https://www.cdc.gov/dpdx/babesiosis/index.html

B. Ehrlichiosis and Anaplasmosis

1. Background & Epidemiology

At least three species of obligate intracellular bacteria are responsible for ehrlichiosis and anaplasmosis cases in the United States: *Ehrlichia chaffeensis*, found primarily in monocytes, and *E. ewingii* and *Anaplasma phagocytophilum,* found primarily in granulocytes. Disease subtypes to be reported are identified according to the etiologic agent: *E. chaffeensis* infection (human ehrlichiosis), *E. ewingii* infection (formerly human monocytic ehrlichiosis) and *A. phagocytophilum* infection (formerly human granulocytic ehrlichiosis or human granulocytic anaplasmosis). The clinical signs of disease that result from infections with these agents are similar, and the range distributions of the agents overlap, so testing for one or more species may be indicated. Differential diagnoses: spotted fever rickettsiosis, bacterial or viral meningitis, relapsed malaria, typhoid fever.

2. Clinical Presentation

Characterized by acute onset of fever and one or more of the following symptoms or signs: headache, myalgia, malaise, anemia, leukopenia, thrombocytopenia, or elevated hepatic transaminases. Nausea, vomiting, or rash may be present in some cases. Severe clinical presentations may include difficulty breathing, hemorrhage, death, and also for anaplasmosis, renal failure or neurological problems. Case fatality rates of ehrlichiosis and anaplasmosis are 1.8% and < 1%, respectively. Persons with compromised immunity or splenectomy appear to develop more severe disease, and may also have higher case-fatality rates.

3. Clinical Criteria for Diagnosis (2010)

Any reported fever AND one or more of the following: headache, myalgia, anemia, leukopenia, thrombocytopenia, or any hepatic transaminase elevation.

4. Laboratory Criteria for Diagnosis (2010)

a. *Ehrlichia chaffeensis* infection or *Anaplasma phagocytophilum* infection

Supportive:

- Serological evidence of elevated IgG or IgM antibody reactive with *E. chaffeensis* or *A. phagocytophilum* antigen by indirect immunofluorescence assay (IFA), enzyme-linked immunosorbent assay (ELISA), dot-ELISA, or assays in other formats (CDC uses an IFA IgG cutoff of ≥1:64 and does not use IgM test results independently as diagnostic support criteria), OR
- *E. chaffeensis*: Identification of morulae in the cytoplasm of monocytes or macrophages by microscopic examination
- *A. phagocytophilum*: Identification of morulae in the cytoplasm of neutrophils or eosinophils by microscopic examination

Confirmed:

- Serological evidence of a fourfold change in IgG-specific antibody titer to *E. chaffeensis* or *A. phagocytophilum* antigen by IFA between paired serum samples (one taken in first week of illness and a second 2-4 weeks later), **OR**

- Detection of *E. chaffeensis* or *A. phagocytophilum* DNA in a clinical specimen via amplification of a specific target by polymerase chain reaction (PCR) assay, **OR**
- Demonstration of ehrlichial or anaplasmal antigen in a biopsy or autopsy sample by immunohistochemical methods, **OR**
- Isolation of *E. chaffeensis* or *A. phagocytophilum* from a clinical specimen in cell culture.

b. *Ehrlichia ewingii* infection

Confirmed:

- Because the organism has never been cultured, antigens are not available. Thus, *E. ewingii* infections may only be diagnosed by molecular detection methods: *E. ewingii* DNA detected in a clinical specimen via amplification of a specific target by PCR assay.

5. Case Classification (2010)

Suspected: A case with laboratory evidence of past or present infection but no clinical information available (e.g., a laboratory report).

Probable: A clinically compatible case (meets clinical evidence criteria) that has supportive laboratory results.

Note: A case that meets clinical evidence criteria with laboratory evidence to support *Ehrlichia* /*Anaplasma* infection, but not with sufficient clarity to definitively place it into one of the categories previously described, is considered an undetermined case of ehrlichiosis/ anaplasmosis, and can only be classified as probable. This may include the identification of morulae in white cells by microscopic examination in the absence of other supportive laboratory results.

Confirmed: A clinically compatible case (meets clinical evidence criteria) that is laboratory confirmed.

6. Comments on Interpretation of Results

Serologic cross-reactions may occur among tests for these etiologic agents and the IgM response may be persistent. Problem cases for which sera demonstrate elevated antibody IFA responses to more than a single infectious agent are usually resolvable by comparing the levels of the antibody responses. Current commercially available ELISA tests are not quantitative and hence not useful for serological confirmation.

Tests of additional sera and further evaluation via PCR, immunohistochemistry, and isolation via cell culture may be needed for further clarification. Cases involving persons infected with more than a single etiologic agent, while possible, are extremely rare.

7. Resources

Ehrlichiosis: https://www.cdc.gov/ehrlichiosis/

Anaplasmosis: https://www.cdc.gov/anaplasmosis/

C. Tick Paralysis

1. Background and Epidemiology

Agent is a neurotoxin secreted in the saliva of certain ticks. If unrecognized, tick paralysis can progress to respiratory failure and may be fatal in approximately 10% of cases. Cases are rare in Washington; usually 0-1 per year and most commonly during spring months in girls (with long hair that conceals ticks) under 10 years old. Differential diagnoses: Guillain-Barré, botulism, myasthenia gravis, polyradiculoneuritis, acute peripheral neuropathy, snakebite.

2. Case Definition

Confirmed: Symptoms consistent with illness (acute, ascending, flaccid paralysis) and rapid improvement of the patient upon removal of tick.

3. **Laboratory Diagnostics:** None other than tick identification.
4. **Resources:** https://www.cdc.gov/mmwr/preview/mmwrhtml/00040975.htm

D. Spotted Fever Rickettsioses

1. Background and Epidemiology

Spotted fever rickettsioses (SFR) are a group of tick-borne infections caused by some members of the bacterial genus *Rickettsia*, and can range from mild illness to fatal disease. The most severe type in the country, Rocky Mountain spotted fever (RMSF), is caused by *Rickettsia rickettsii*. RMSF cases occur throughout the United States, but are most commonly reported from five states: NC, TN, MO, AR, and OK; which also account for >60% of SFR cases. Typically, 0-3 cases are reported annually in Washington; with most exposures out of state. Most cases occur April through September when ticks are active.

Additional SFRs occur worldwide and also result in a broad range of illnesses. The most commonly reported SFRs among Washington residents who travel internationally are African tick bite fever (*R. africae*) and Mediterranean spotted fever (*R. conorii*). Differential diagnoses: babesiosis, ehrlichiosis and anaplasmosis, bacterial or viral meningitis, drug allergy mononucleosis, measles, relapsing fever, streptococcal infection, syphilis, toxic shock syndrome, tularemia, typhoid, typhus.

2. Clinical Presentation

For RMSF, illness is characterized by acute onset of fever, and may be accompanied by headache, malaise, myalgia, nausea/vomiting, or neurologic signs; a macular or maculopapular rash appears 4-7 days following onset, often present on the palms and soles. Untreated disease may lead to more severe manifestations that include encephalitis, shock, seizures, gangrene, acute respiratory and renal failure, and death. The case-fatality rate is 13-25% if untreated and 4% even with appropriate antibiotic treatment. Children frequently experience gastrointestinal symptoms, altered mental status, and edema involving hands or eyes. Petechiae are a sign of progression to severe disease and every attempt should be made to begin treatment for severe cases before petechiae develop.

Other SFRs may have similar, but milder, clinical presentation than RMSF, and may cause an eschar (ulcerated, necrotic region) at the site of tick attachment that appears before onset of fever.

3. Clinical Criteria (2020)

Fever as reported by the patient or a healthcare provider, AND one or more of the following: rash, eschar, headache, myalgia, anemia, thrombocytopenia, or any hepatic transaminase elevation.

4. Laboratory Criteria (2020)

For the purposes of surveillance:

Confirmed:

- Serological evidence of a fourfold increase in IgG-specific antibody titer reactive with spotted fever group-*Rickettsia* (SFGR) antigen by indirect immunofluorescence assay (IFA) between paired serum specimens (one taken in the first two weeks after illness onset and a second taken 2-10 weeks after acute specimen collection)*, **OR**
- Detection of SFGR nucleic acid in a clinical specimen via amplification of a *Rickettsia* genus- or species-specific target by PCR assay, **OR**
- Demonstration of SFGR antigen in a biopsy or autopsy specimen by IHC, **OR**
- Isolation of *R. rickettsii* or other SFGR from a clinical specimen in cell culture and molecular confirmation (e.g., PCR or sequence.

Presumptive:

- Has serologic evidence of elevated IgG antibody at a titer ≥1:128 reactive with SFGR antigen by IFA in a sample taken within 60 days of illness onset.**

Supportive:

- Has serologic evidence of elevated IgG antibody at a titer <1:128 reactive with SFGR antigen by IFA in a sample taken within 60 days of illness onset.

*A four-fold rise in titer should not be excluded (as confirmatory laboratory criteria) if the acute and convalescent specimens are collected within two weeks of one another.

**This includes paired serum specimens without evidence of fourfold rise in titer, but with at least on single titer ≥1:128 in IgG-specific antibody titers reactive with SFGR antigen by IFA.

5. Case Classification (2020)

Suspected: A case with confirmatory or presumptive laboratory evidence of infection with no clinical information available (e.g., a laboratory report), OR

A clinically compatible case (meets clinical criteria) that has supportive laboratory evidence.

Probable: A clinically compatible case (meets clinical evidence criteria) that has presumptive laboratory results.

Confirmed: A clinically compatible case (meets clinical evidence criteria) that is laboratory confirmed.

6. **Comments on Interpretation of Results**

   The organism in the acute phase of illness is best detected by polymerase chain reaction (PCR) and immunohistochemical methods (IHC) in skin biopsy specimens, and occasionally by PCR in appropriate whole blood specimens taken during the first week of illness, prior to antibiotic treatment. Serology can also be employed for detection, however an antibody response may not be detectable in initial samples, and paired acute and convalescent samples are essential for confirmation.

   R. rickettsii (RMSF) do not circulate in large numbers in the blood until the disease has progressed to a severe phase of infection. For this reason, whole blood specimens obtained during the first several days of illness are often negative when PCR or culture.

   Current commercially available ELISA tests are not quantitative and hence not useful for serological confirmation. Furthermore, IgM tests are not always specific and the IgM response may be persistent. Therefore, IgM tests are not strongly supported for use in serodiagnosis of acute disease.

7. **Resources:** https://www.cdc.gov/rmsf/

4. DIAGNOSIS AND LABORATORY SERVICES

A. Diagnosis

Appropriate diagnostic testing depends on the suspected agent. Commercial laboratory tests may be unreliable for many of these tick-borne diseases, so confirmation by a reference laboratory may be appropriate. Any suspected cases of anaplasmosis, ehrlichiosis, babesiosis, or rickettsioses with possible acquisition in Washington should have specimens forwarded for confirmatory testing at CDC.

B. Tests Available at the Washington State Health Public Health Laboratories (PHL)

Consult with Communicable Disease Epidemiology (CDE) for assistance with diagnosis and testing (206-418-5500).

- PHL can identify tick species associated with any tick-borne disease and confirm *Babesia spp.* on blood smears. PHL can also arrange testing at CDC for skin or tissue specimens, serum, and whole blood. Laboratory diagnosis does not exist for tick paralysis; ticks can be submitted for species identification. Tick, blood smear, or tissue specimens should be submitted with a Microbiology/Parasitology form https://www.medialab.com/dv/dl.aspx?d=1887088&dh=52b1a&u=69790&uh=0e2a1
- Submit serum in red or tiger top tubes spun down and whole blood in EDTA (purple top) tubes. Each specimen should be accompanied by its own PHL Serology form https://www.medialab.com/dv/dl.aspx?d=1615463&dh=e4b87&u=69790&uh=0e2a1
- Note that Washington State Public Health Laboratories (PHL) require all clinical specimens have two patient identifiers, a name **and** a second identifier (e.g., date of birth) both on the specimen label and on the submission form. Due to laboratory accreditation standards, specimens will be rejected for testing if not properly identified. Also include specimen source and collection date.

- For appropriate collection, storage, and shipping details, see: http://www.doh.wa.gov/ForPublicHealthandHealthcareProviders/PublicHealthLaboratories/MicrobiologyLabTestMenu

5. ROUTINE CASE INVESTIGATION

Interview the case and others who may be able to provide pertinent information.

A. Evaluate the Diagnosis

If the case tests positive for tick-borne disease at a laboratory other than PHL, discuss the need to perform confirmatory testing with Communicable Disease Epidemiology (206-418-5500). As needed, facilitate transport of the specimen to PHL for further testing.

Determine if others are at risk through shared exposure. See Section 6 for brief descriptions of investigations for selected conditions. Consult with CDE for assistance with performing a public health investigation for other agents. The reporting form for Tick-borne Diseases is available at: https://www.doh.wa.gov/Portals/1/Documents/5100/420-214-ReportForm-Tickborne.pdf.

B. Manage the Case

1. Hospitalized cases should be treated with standard precautions.
2. Assess evidence or risk of local transmission. Other than tick paralysis, each condition described here either has not been identified in Washington or is very rarely reported in Washington. Identify any travel during the patient's exposure period (including specific locations and travel dates), as well as possible exposures including: exposure to tick habitats, contact with dogs and wildlife, and potential tick bites with emphasis on locally acquired infection. If local exposure is suspected, collect detailed location information.
3. Ask about receiving or donating blood products and about organ or tissue transplant or donation. See section 6 for disease-specific donor follow-up.
4. Controlling further spread: Educate those sharing a case's exposure about tick-borne disease and encourage them to seek care if consistent illness develops.

6. MANAGING SPECIFIC DISEASES

A. Babesiosis

Cases must defer from blood donation for life.

If the patient under investigation donated blood or organs while possibly infectious, inform the blood or tissue bank of the potential exposure risk to others. Obtain the date and location of transfusions of any products from the infected patient. Identify possible contaminated product(s) within the appropriate window. If any specimens are still available, arrange for testing. Notify other partners, including health departments in other states if blood units were transferred. Work with the blood collection facility to identify all persons who received specimens from the infected patient and ensure testing.

If the patient under investigation received blood or organs from a donor during their exposure period, obtain date(s) and location(s) of recent transfusions/transplants. Check on the availability of pre-transfusion specimens to use as baseline for testing. Acquire unit numbers, type of blood component, and associated facility for each transfusion.

Notify the blood center of potential transfusion-associated infection and determine their standard procedures for donor contact and testing.

Resources:

https://www.cdc.gov/bloodsafety/tools/investigation-toolkit.html

https://www.cdc.gov/parasites/babesiosis/resources/50.153.pdf

https://www.cdc.gov/bloodsafety/pdf/Generic_Transfusion_Investigation_form.pdf

B. Ehrlichiosis and Anaplasmosis

Doxycycline is the first line treatment for adults and children of all ages and should be initiated immediately whenever ehrlichiosis or anaplasmosis are suspected. Transfusion-associated anaplasmosis is rare but possible. Patients who develop anaplasmosis within a month of receiving a blood transfusion or solid organ transplant should be investigated as a possible transfusion-associated case. Patients who develop ehrlichiosis within a month of receiving a blood transfusion or solid organ transplant should be investigated although no cases of transmission by blood transfusion or organ donation have been confirmed.

C. Spotted fever rickettsiosis

Doxycycline is the first line treatment for adults and children of all ages and should be initiated immediately for all suspected rickettsial infections. Early treatment can prevent death and severe illness.

D. Tick paralysis

Carefully check patient for ticks, especially along the hairline. Prompt removal of the tick usually results in complete recovery within 24 hours.

E. Environmental Evaluation/Management

Consider outreach to educate the public about avoiding tick exposure. Environmental measures to reduce ticks around the home include modifying landscape to create tick-safe zones. Removing leaf litter and clearing tall grasses and brush around homes, placing wood chips or gravel between lawns and wooded areas, and keeping play areas away from shrubs, bushes, and other vegetation may help to reduce exposures. Notify local environmental health program and/or vector control of locally acquired cases.

7. ROUTINE PREVENTION

A. Immunization Recommendations

Vaccines for tick-borne diseases included in this guideline are not currently available in the United States.

B. Prevention Recommendations

When spending time outdoors in risk areas, persons should:

1. Treat clothing and gear with products containing permethrin.
2. Use EPA registered insect repellent on exposed skin, following label instructions. Products containing DEET, picaridin, IR3535, Oil of Lemon Eucalyptus, or 2-undecanone are very effective. Carefully follow instructions on the label. Take special care when using repellents on children.

3. Wear long pants and a long-sleeved shirt. Tuck pant legs into socks or boots and shirt into pants to help keep ticks on the outside of clothing where they can be more easily spotted and removed.
4. Wear light colored, tightly woven clothing which will allow the darker tick to be seen more easily. The tight weave makes it harder for the tick to attach itself.
5. Tumble clothes in a dryer on high heat for 10 minutes to kill ticks on dry clothing after you come indoors.
6. After potential exposures, check yourself, your children, pets, and gear thoroughly for ticks. Carefully inspect areas around the head, neck, ears, and hairline. If you find a tick attached to your skin, promptly remove it, including all mouthparts, which contain the salivary glands. Grasp the tick using tweezers as close to the skin as possible. With a steady motion, pull the tick straight out. Wash your hands and apply antiseptic to the bite. Do twist or jerk the tick; this can cause the mouth-parts to break off and remain in the skin. For more information about removing a tick, visit: https://www.cdc.gov/ticks/removing_a_tick.html.
7. Monitor the bite and be alert for early symptoms of tick-borne disease, e.g. fever or rash over the next month or so.
8. Additional information regarding prevention of tick bites and tick repellant is available at CDC: https://www.cdc.gov/ticks/avoid/on_people.html

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UPDATES

April 2018: This guideline was created based on the previous guideline for “Rare diseases of public health significance”.

January 2020: The CSTE case definition for Spotted Fever Group Rickettsiosis was updated to the 2020 definition.

December 2022: For January 2023 WAC revision combined provider and facility reporting requirement, updated laboratory submission (Section 1B)

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