

SPOTTED FEVER RICKETTSIOSIS

REPORTING INFORMATION

- **Class B:** Report by the end of the business day in which the case or suspected case presents and/or a positive laboratory result to the local public health department where the patient resides. If patient residence is unknown, report to the local public health department in which the reporting health care provider or laboratory is located.
- Reporting Form(s) and/or Mechanism:
 - [Ohio Confidential Reportable Disease form](#) (HEA 3334, rev. 1/09), [Positive Laboratory Findings for Reportable Disease form](#) (HEA 3333, rev. 8/05), the local public health department via the Ohio Disease Reporting System (ODRS), or telephone.
 - The Centers for Disease Control and Prevention (CDC) [Tick-borne Rickettsial Disease Case Report form](#) (CDC 55.1, rev. 10/09) is available for use to assist in local disease investigation. Information collected from the form should be entered into ODRS and sent to ODH. The mailing address for this form is: Ohio Department of Health, Zoonotic Disease Program, 35 E. Chestnut Street, Columbus, OH 43215.
- Key fields for ODRS reporting include: the illness onset date, Symptoms and signs, fields in the Epidemiology Information module and fields in the Travel History module.

AGENT

Rickettsia species, including but not limited to *R. rickettsia*, and *R. parkeri*.

Table 1: Other Spotted Fever *Rickettsia* transmitted by ticks in the United States

Species	Tick Vector	Geographic Distribution	Clinical Symptoms
<i>Rickettsia parkeri</i>	<i>Amblyomma maculatum</i> (Gulf Coast tick)	Eastern and southern U.S., particularly along the coast	Fever, headache, eschar(s), variable rash
<i>Rickettsia species 364D</i>	<i>Dermacentor occidentalis</i> (Pacific Coast tick)	Northern California, Pacific Coast	Fever, eschar(s)

Table 2. Other Spotted Fever *Rickettsia* transmitted by ticks internationally

Disease	Species	Geographic Distribution	Clinical Symptoms
Rickettsiosis	<i>Rickettsia aeschlimannii</i>	Africa, Mediterranean region	Fever, eschar, maculopapular rash
African tick- bite fever	<i>Rickettsia africae</i>	Sub-Saharan Africa, West Indies	Fever, eschar, maculopapular rash

Table 2. Other Spotted Fever *Rickettsia* transmitted by ticks internationally

Disease	Species	Geographic Distribution	Clinical Symptoms
Queensland tick typhus	<i>Rickettsia australis</i>	Australia, Tasmania	Fever, eschar, regional adenopathy, rash on extremities
Mediterranean spotted fever or Boutonneuse fever	<i>Rickettsia conorii</i> †	Mediterranean region and Africa to Indian subcontinent	Fever, eschar (usually single), regional adenopathy, maculopapular rash on extremities
Far eastern spotted fever	<i>Rickettsia heilongjiangensis</i>	Northern China, Eastern Asia	Fever, eschar, maculopapular rash, regional adenopathy
Aneruptive fever	<i>Rickettsia helvetica</i>	Central and northern Europe	Fever, headache, myalgia
Flinders Island spotted fever, Thai tick typhus	<i>Rickettsia honei</i>	Australia, Thailand	Mild spotted fever, eschar and adenopathy are rare
Japanese spotted fever	<i>Rickettsia japonica</i>	Japan	Fever, eschar(s), regional adenopathy, rash on extremities
Australian spotted fever	<i>Rickettsia marmionii</i> subspecies	Australia	Fever, eschar, maculopapular or vesicular rash, adenopathy
<i>Rickettsia massiliae</i> rickettsioses	<i>Rickettsia massiliae</i>	France, Greece, Spain, Portugal, Switzerland, Sicily, Central Africa and Mali	Fever, maculopapular rash, necrotic eschar
Rocky Mountain spotted fever, febre maculosa, Sao Paulo exanthematic typhus, Minas Gerais exanthematic typhus, Brazillian spotted fever	<i>Rickettsia rickettsii</i>	North, Central and South America	Fever, headache, abdominal pain, maculopapular rash progressing into papular or petechial rash (generally originating on extremities)
North Asian tick typhus, Siberian tick typhus	<i>Rickettsia sibirica</i>	Broadly distributed	Fever, eschar(s), regional adenopathy,

Table 2. Other Spotted Fever *Rickettsia* transmitted by ticks internationally

Disease	Species	Geographic Distribution	Clinical Symptoms
		through north Asia	maculopapular rash
Lymphangitis associated rickettsiosis	<i>Rickettsia sibirica mongolotimonae</i>	Southern France, Portugal, China, Sub-saharan Africa	Fever, multiple eschars, regional adenopathy and lymphangitis, maculopapular rash
Tick-borne lymphadenopathy (TIBOLA), Dermacentor-borne necrosis and lymphadenopathy (DEBONEL)	<i>Rickettsia slovaca</i>	Southern and eastern Europe, Asia	Necrosis erythema, cervical lymphadenopathy and enlarged lymph nodes, rare maculopapular rash

CASE DEFINITION

Clinical Description

Spotted fever rickettsioses are a group of tick-borne infections caused by some members of the genus *Rickettsia*. Rocky Mountain spotted fever (RMSF) is an illness caused by *Rickettsia rickettsii*, a bacterial pathogen transmitted to humans through contact with ticks. *Dermacentor* species of ticks are most commonly associated with infection, including *D. variabilis* (the American dog tick) and *D. andersoni* (the Rocky Mountain wood tick) and more recently *Rhiphicephalus sanguineus* (the brown dog tick). Disease onset averages one week following a tick bite. Age specific illness is highest for children and older adults. 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 is reported in many, about 80% of patients, 4-7 days post-onset, and is often present on the palms and soles. RMSF is fatal as many as 20% of untreated cases and severe fulminant disease is possible.

In addition to RMSF, human illness associated with other spotted fever group *Rickettsia* species, including infection with *Rickettsia parkeri* (associated with *Amblyomma maculatum* ticks), has also been reported. In these patients, clinical presentation appears similar to, but may be milder than, RMSF; the presence of an eschar (blackened or crusted skin) at the site of tick attachment has been reported for some other spotted fever rickettsioses.

Laboratory Criteria for Diagnosis

For the purposes of surveillance:

Laboratory Confirmed:

- Serological evidence of a fourfold change in immunoglobulin G (IgG)-specific antibody titer reactive with *Rickettsia rickettsii* or other spotted fever group antigen by indirect immunofluorescence assay (IFA) between paired serum specimens (one taken in the first week of illness and a second 2-4 weeks later), *or*
- Detection of *R. rickettsii* or other spotted fever group DNA in a clinical specimen via amplification of a specific target by PCR assay, *or*

- Demonstration of spotted fever group antigen in a biopsy or autopsy specimen by IHC, *or*
- Isolation of *R. rickettsii* or other spotted fever group from a clinical specimen in cell culture.

Laboratory Supportive:

- Has serologic evidence of elevated IgG or IgM antibody reactive with *R. rickettsii* or other spotted fever group antigen by IFA, enzyme-linked immunosorbent assay (ELISA), dot-ELISA, or latex agglutination.

Note

Current commercially available ELISA tests are not quantitative, cannot be used to evaluate changes in antibody titer, and hence are not useful for serological confirmation. IgM tests are not strongly supported for use in serodiagnosis of acute disease, as the response may not be specific for the agent (resulting in false positives) and the IgM response may be persistent. Complement fixation (CF) tests and other older test methods are neither readily available nor commonly used. CDC uses in-house IFA IgG testing (cutoff of $\geq 1:64$), preferring simultaneous testing of paired specimens, and does not use IgM results for routine diagnostic testing.

Case classification

Suspect: 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; see below) that has supportive laboratory results.

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

Comments

Acute 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.

Clinical evidence

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

Exposure

Exposure is defined as having been in potential tick habitats within the past 14 days before onset of symptoms. Occupation should be recorded if relevant to exposure. A history of a tick bite is not required.

SIGNS AND SYMPTOMS

The classic findings for this disease are fever, rash, and history of tick bite. However, this combination is not always detected when the patient initially presents for care.

Initial Signs and Symptoms

Initial symptoms of tick-borne spotted fever group rickettsia (SFGR) infections generally

include fever, headache, fatigue, and muscle aches. A maculopapular or petechial rash may be present, and frequently a distinctive eschar (blackened or crusted skin) may develop at the site of a tick bite. Multiple eschars may be present if more than one tick bite occurred. The observance of an eschar at the site of tick bite may provide the clinician with a diagnostic clue that can help differentiate the infection from RMSF, although eschars may also be rarely reported with *R. rickettsii* infection.

Initial symptoms for RMSF generally include fever, nausea, vomiting, severe headache, muscle pain, lack of appetite. The rash first appears 2-5 days after the onset of fever and is often not present or may be very subtle when the patient is initially seen by a physician. Younger patients usually develop the rash earlier than older patients. Most often it begins as small, flat, pink, non-itchy spots (macules) on the wrists, forearms, and ankles. These spots turn pale when pressure is applied and eventually become raised on the skin.

Later Signs and Symptoms

Later signs and symptoms include rash, abdominal pain, joint pain, and diarrhea. The characteristic red, spotted (petechial) rash of Rocky Mountain spotted fever is usually not seen until the sixth day or later after onset of symptoms, and this type of rash occurs in only 40% to 60% of patients with Rocky Mountain spotted fever. The rash involves the palms or soles in as many as 50% to 60% of adults and more than 90% of children. As many as 10% to 15% of patients may never develop a rash.

DIAGNOSIS

Different SFGR pathogens cause immune reactions in humans that can be difficult to distinguish with antibody-based laboratory techniques. Because these agents exhibit serologic cross-reactivity with available tests for *R. rickettsii*, some human illnesses currently being attributed to RMSF in the United States may actually be caused by other SFGR, such as *R. parkeri*, *Rickettsia* 364D, or imported spotted fevers.

Although the severity of infections attributable to SFGR varies greatly depending on the causative species, all suspect patients should be treated as if they have *R. rickettsii* infection. Physicians seeking confirmation of infection with a SFGR pathogen may elect to use commercially available serologic assays that diagnose RMSF, and should report it as a case of "Spotted Fever Rickettsiosis" to their state health department. Additional methods that may be used to help identify the causative agent include polymerase chain reaction (PCR) assay, immunohistochemistry (IHC), and culture isolation of a swab or biopsy from an eschar or rash site. Specimens should be submitted to the state health department in the state where the patient resides, who can submit the samples to CDC for testing.

A diagnosis of Rocky Mountain spotted fever is based on a combination of clinical signs and symptoms and confirmatory laboratory tests. Other common laboratory findings suggestive of Rocky Mountain spotted fever include thrombocytopenia, hyponatremia, and elevated liver enzyme levels.

Evaluation of both acute and convalescent serum is recommended. The convalescent serum should be drawn about 2 - 4 weeks post-onset. The single convalescent serum is acceptable for testing if the acute sample is not available.

EPIDEMIOLOGY

Source

The vector of *R. parkeri* is the Gulf Coast tick (*Amblyomma maculatum*) and is typically found in eastern and southern United States, particularly along the coast.

R. rickettsii is maintained and amplified by hard ticks, primarily the American dog tick (*D. variabilis*) and the Rocky Mountain wood tick (*D. andersoni*). The Brown dog tick (*Rhipicephalus sanguineus*) and the Cayenne tick (*Amblyomma cajennense*) have also been implicated as vectors. Amplification of the organism occurs in meadow voles, one of the vertebrate hosts of immature ticks.

Occurrence

Although other species of rickettsiae cause similar illnesses worldwide, *R. rickettsii* and *R. parkeri* are restricted to the Americas. In the United States, RMSF was first described from the Rocky Mountain region, but now the majority of cases are reported from the southern states, from North Carolina to Oklahoma. Although all ages are susceptible, children predominate, probably because of greater contact with dogs and tick habitat. Most cases occur in May and June, the peak American dog tick season in Ohio, with fewer cases from July to September.

Mode of Transmission

Humans contract RMSF through the bite of the dog tick (at least 4 to 6 hours of attachment are required), or by coming in contact with tick secretions or body fluids through careless handling of ticks. In Ohio, the American dog tick is the vector. Dogs can transport ticks into the household environment and may also become ill with spotted fever.

Period of Communicability

Humans are dead-end hosts, not being able to infect ticks or other humans.

Incubation Period

The incubation period is 3 to 14 days after infected tick contact.

PUBLIC HEALTH MANAGEMENT

Case

Investigation

A history of the patient's travel and contact with dogs and ticks is obtained for the 14 days prior to onset. Outdoor occupational or recreational activities by the patient during April-September may provide additional information.

Treatment

Tick-borne spotted fever rickettsiosis infections are best treated by using a tetracycline antibiotic, usually doxycycline. Patients are treated for at least 3 days after the fever subsides and until there is evidence of clinical improvement. Standard duration of treatment is 7 to 14 days. Because laboratory confirmation is generally not available during acute illness, treatment is initiated based on clinical and epidemiological information.

Isolation and Follow-up Specimens

Isolation is not indicated. Convalescent specimens should be collected 2 – 4 weeks after disease onset.

Contacts

No treatment or prophylaxis of contacts is indicated. There is currently no vaccine for SFGR.

Prevention and Control

Tick avoidance in endemic areas is probably the best preventive measure at present.

Tuck pants cuffs into sock tops, spray insect repellent on pants and socks and wear light-colored clothing to facilitate frequent checks for crawling ticks. Inspect every hour or two for attached and crawling ticks. Remove ticks promptly. Inspect pets for ticks every day. Keep grass and weeds mowed short. With the identification of endemic areas from case investigations, community education and awareness activities should be initiated before the beginning of tick season (late April). Area residents should be made aware of SFGR symptoms, measures to reduce tick infestations (mowing, dog control, daily inspections of dogs), and precautions on handling ticks to reduce exposure. Specific fliers and posters and informative articles in the media can all be used to promote public awareness of ticks and SFGR.

What is Spotted Fever Rickettsiosis?

Spotted fever group rickettsia (SFGR) is the most severe and the most frequently reported tick-borne illness in the United States. This disease, affecting humans and dogs, is caused by several species of *Rickettsia* found in the United States.

In the last 50 years, approximately 250-1,200 cases of Rocky Mountain spotted fever have been reported annually in the USA. It is likely that many more cases go unreported. States with the highest incidences of RMSF cases (35%) were North Carolina and Oklahoma. Since the year 2000, Ohio has seen between 2 and 31 cases per year.

How do people get Spotted Fever Rickettsiosis?

The bacterium that causes SFGR is transmitted by the bite of an infected tick. The most common tick in Ohio, the American dog tick, is the primary carrier for RMSF. Rocky Mountain wood ticks and the Brown dog tick have also been known to carry RMSF.

RMSF can not be contracted directly from dogs or other people.

Who is most at risk for getting Spotted Fever Rickettsiosis?

People who spend time in the outdoors in tick-infested environments especially woodlands and brushy areas, are at an increased risk of exposure. Dogs or other pets that frequent these types of areas may also bring infected ticks home.

How long after a tick bite before symptoms appear?

Symptoms usually appear within 3 to 14 days.

What are the symptoms of Spotted Fever Rickettsiosis?

Early stages of disease are nonspecific (fever, nausea, body aches, loss of appetite, vomiting, and severe headache). Later signs may include a rash, abdominal pain, joint pain and diarrhea. The rash usually starts on the arms and ankles and moves to the palms of the hands or soles of the feet. Three things that may suggest RMSF infection are fever, rash and history of a tick bite. RMSF can be a very severe illness and require hospitalization. The bacteria attack the cells lining blood vessels throughout the body and can involve the lungs, brain or kidneys.

How is Spotted Fever Rickettsiosis diagnosed?

A diagnosis of SFGR is based on a combination of clinical signs and symptoms and specialized confirmatory laboratory tests. Other common laboratory findings suggestive of Rocky Mountain spotted fever include thrombocytopenia (decreased platelets), hyponatremia (low blood sodium), and elevated liver enzyme levels.

How is Spotted Fever Rickettsiosis treated?

SFGR is often treated with tetracycline class antibiotics, usually doxycycline.

Can a person get Spotted Fever Rickettsiosis more than once?

Previous infection is thought to provide long lasting immunity against re-infection. However, this should not deter persons from practicing good tick-preventive measures or visiting a physician if signs and symptoms consistent with SFGR occur, especially following a tick bite, as other diseases may also be transmitted by ticks.

What can be done to prevent Spotted Fever Rickettsiosis?

Avoid areas where ticks might be present: tall grass, high brush, weedy or wooded areas. When entering these areas take the following precautions to reduce the risk of acquiring tick-borne diseases:

- Wear light-colored, long pants, tuck pant cuffs into sock tops and spray pant legs and socks with insect repellent. Repellents containing 0.5% permethrin or 20-30% DEET are effective in repelling ticks. Follow application directions carefully.
- When possible, avoid walking in tall grass and weeds.
- Conduct visual "tick checks" on yourself and children every hour or two.
- Check pets for ticks before allowing them into the home.
- Carefully remove attached ticks as soon as possible.
- Keep yard and play areas well mowed to discourage ticks.

How should a tick be removed?

Since disease transmission occurs within hours of attachment, it is important to remove ticks as soon as possible after discovery.

To remove an attached tick, grasp it with tweezers as close as possible to the skin and pull with firm, steady pressure straight out. Do not twist or jerk the tick, as the mouthparts may break off. If tweezers are not available, protect fingers with rubber gloves or tissue paper.

- Do not handle ticks with bare hands.
- Do not squeeze, crush or puncture the body of the tick as it may contain infected fluids.
- After removing the tick, thoroughly disinfect the bite site and wash your hands.
- See or call your doctor if there is a concern about incomplete tick removal.

For more information, contact your local health department or the Zoonotic Disease Program at ODH by calling 614-752-1029.

For more information please visit these websites:

CDC SFGR: <http://www.cdc.gov/otherspottedfever/>

CDC RMSF: <http://www.cdc.gov/rmsf/>

ODH Zoonotic Disease Program Tick-borne Diseases (statistics and educational materials):

<http://www.odh.ohio.gov/odhPrograms/dis/zoonoses/vbdp/vbtick.aspx>