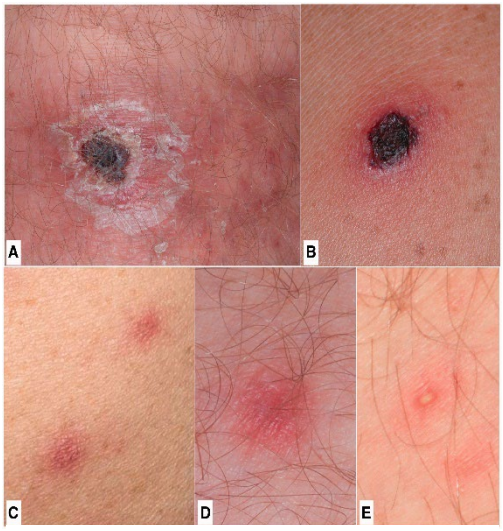
NJDOH Tickborne Disease Update
Rickettsia parkeri rickettsiosis and the Gulf Coast tick – July 2022

Spotted Fever Group Rickettsioses (SFGR)

Spotted Fever Group Rickettsioses (SFGR) are a group of diseases caused by genetically similar intracellular bacteria spread to people through the bites of infected ticks and mites. Infections with SFGR species can range from asymptomatic to serious and even fatal when left untreated. Rocky Mountain spotted fever (RMSF) is the most serious and commonly reported spotted fever group rickettsiosis in the United States and is caused by *Rickettsia rickettsii*. Other causes of spotted fevers in the United States include *Rickettsia parkeri* rickettsiosis, caused by *R. parkeri;* Pacific Coast tick fever, caused by *Rickettsia* species 364D; and Rickettsialpox, caused by *Rickettsia akari* (mouse mites).

Rickettsia parkeri

In 1937, a unique spotted fever rickettsia borne by the Gulf Coast tick (*A. maculatum*) was identified and eventually named *Rickettsia parkeri*. In 2004, the first confirmed human infection with *R. parkeri* was described and since that time, more than 40 patients have been identified. Human cases have traditionally been reported in southern states, but as the Gulf Coast tick expands its range, including into N.J., healthcare providers should be aware of *R. parkeri* when evaluating patients for a tickborne disease.



Clinical appearance of cutaneous lesions associated with *R. parkeri* rickettsiosis in humans, including inoculation eschars (A and B) and maculopapular, vesicular, or pustular exanthems (C through E). *J Med Entomol*, Volume 52, Issue 2, March 2015, Pages 230–252, https://doi.org/10.1093/jme/tju022

Clinical Description: Spotted fevers can range from relatively mild infections to fatal disease. Infections caused by *R. parkeri* are generally less severe than RMSF. Hospitalizations occur less frequently from these spotted fevers and deaths have not been reported. Some patients may resolve without treatment. Two to ten days after tick exposure, patients with *R. parkeri* rickettsiosis typically develop a necrotic inoculation eschar, followed by a fever, muscle pain, headache, and rash. Rash is often described as maculopapular or vesicular eruptions on the trunk and extremities. Regional lymphadenopathy is detected in about 25% of patients. Gastrointestinal symptoms are rare. Patients often develop mildly elevated levels of hepatic transaminases, mild leukopenia, and less frequently mild thrombocytopenia.

Diagnosis and Specialized Testing: Testing for SFGR at commercial laboratories looks for antibodies using an indirect immunofluorescence antibody (IFA) assay (IgG antibodies are more reliable than IgM antibodies). Unfortunately, IFA cannot provide species-specific results and there is cross-reactivity among spotted fever and typhus group rickettsioses. An acute and convalescent sample collected 2-4 weeks later is needed to confirm infection (4-fold or greater increase in IgG titer). Antibodies take 7-10 days after illness onset to reach detectable levels and a negative result during the first week of illness is common. A measurable titer in the first week of illness is likely more reflective of past exposure than current illness. In most patients with a spotted fever group rickettsiosis, the first IgG IFA titer is negative

and the second typically shows a four-fold or greater increase in IgG antibody levels. Unfortunately, serological testing cannot distinguish between RMSF, *Rickettsia parkeri*, or other spotted fever group rickettsioses.

Public Health Testing: While PCR testing is effective for testing some rickettsial diseases (e.g., anaplasmosis and ehrlichiosis), spotted fever group rickettsia circulate at low levels in the blood in the early stages of disease, making PCR less sensitive. Eschars, however, can contain large amounts of rickettsial DNA. Health care providers can submit eschar swabs (or rash biopsies) to the N.J. Public Health and Environmental Laboratory for PCR testing (with NJDOH pre-approval). Note that swabs should be collected before or within 24 hours of initiating antibiotic therapy. Refer to the NJDOH webpage on spotted fever group rickettsioses for specimen collection guidance.

Treatment: Doxycycline is the treatment of choice for all suspected rickettsial infections, including RMSF and *R. parkeri* rickettsiosis. Empiric treatment with doxycycline is recommended in patients of all ages, as it is most effective at preventing death and severe illness when started within the first 5 days of symptoms. The use of doxycycline to treat suspected rickettsial disease in children is standard practice recommended by both CDC and the American Academy of Pediatrics Committee on Infectious Diseases. When a patient is treated within the first 5 days of illness, fever generally subsides within 24-48 hours. Failure to respond to doxycycline suggests that the patient's condition might not be caused by rickettsial infection.

Gulf Coast Tick (*Amblyomma maculatum*)

Amblyomma maculatum (Gulf Coast tick) is the principal vector of *Rickettsia parkeri*, but also *Hepatozoon americanum*, which is responsible for American canine hepatozoonosis. There have also been two reports of tick bite paralysis associated with this tick. The Gulf Coast tick is distributed throughout much of the southeastern and south-central United States, as well as several countries throughout Central and South America. Its range has expanded from the Gulf Coast in recent years into the southern plain states and the mid-Atlantic region, with detections in states surrounding New Jersey. While isolated reports of the Gulf Coast tick have been reported in New Jersey, an established population has been detected for the first time this summer in Salem County.

Adult female & male Gulf Coast ticks, J. Occi, NJDOH

R. parkeri has been detected in or isolated from Gulf Coast ticks collected in many states, including N.J. (testing performed at Rutgers University Center for Vector Biology), indicating that this pathogenic rickettsia is endemic throughout a relatively large expanse of the United States. While the total number of ticks tested is small, reports have documented a 21% *R. parkeri* infection rate (25 out of 119 ticks) in Delaware and 50% infection rate (5 out of 10) in Staten Island, New York.

Early reports suggested that southern coastal habitats with higher rainfall, humidity, and temperature were important parameters for this tick. Nonetheless, the Gulf Coast tick has demonstrated its capacity to withstand relatively drier, hotter, and more exposed habitats. Host-seeking adult A. maculatum ticks

remain active during mid-to-late summer, are characteristically found in open, nonshaded habitats, and are most responsive to host stimuli during the hottest period of the day.

Life stages of the Gulf Coast tick. From left: larva, nymph, adult male, and adult female. Each stage can feed on human hosts and can be infected with *Rickettsia parkeri*. The head of a pin is included for scale. https://academic.oup.com/cid/article/47/9/1188/461033

In the U.S., the Gulf Coast tick has been collected from at least 71 species of birds and mammals. The immature stages of A. maculatum parasitize a great diversity of passerine birds, as well as various rodents (e.g., cotton rats, mice, and voles). Adult-stage Gulf Coast ticks parasitize a varied group of medium-to-large mammalian hosts that include white-tailed deer, coyotes, dogs, cattle, horses, sheep, and swine. It is likely that various domesticated and wildlife hosts of may have contributed to transferring the tick to new favorable habitats.

Veterinary Importance

American canine hepatozoonosis (ACH): Dogs are often parasitized by Gulf Coast ticks in endemic areas in the U.S. American canine hepatozoonosis (ACH) is a severe and potentially fatal infection caused by the parasite *Hepatozoon americanum*, which is transmitted not by a tick bite but by dogs ingesting infected Gulf Coast ticks. Dogs acquire infection by ingesting nymphal or adult Gulf Coast ticks that, in a previous life stage, ingested the parasite in a blood meal taken from some vertebrate intermediate host. Ingestion likely occurs either through grooming infected ticks from their coats or from ingesting ticks accidentally as they maul or eat prey that harbor the ticks. ACH is caused by the apicomplexan *H.americanum*. Clinical signs develop within 4 to 10 weeks and include fever, weakness and reluctance to move, lethargy, mucopurulent ocular discharge, generalized pain or hyperesthesia, altered gait, muscle atrophy, especially of the head, and gradual deterioration of body condition. Laboratory findings demonstrate a persistent and predominantly neutrophilic leukocytosis, a mild moderate normochromic, normocytic, nonregenerative anemia, hypoglycemia, hypoalbumineamia, and mildly elevated levels of serum alkaline phosphatase. Radiographs often reveal disseminated proliferation of the periosteum, particularly around the diaphysis of the proximal long bones of the limbs. These lesions range from slightly elevated plaques of porous bone to concentrically thickened regions that are generally most severe on the femur and humerus. Peripheral blood smears rarely demonstrate the organism; buffy coat smears may be conducted to increase the chance of detecting the organism. Muscle biopsy is the most consistently reliable method of obtaining a differential diagnosis. Diagnostic polymerase chain reaction (PCR) is also available and may aid diagnosis is some cases. Infection may persist in some dogs greater than 5 years; however, most dogs with ACH die within 1 to 2 years without supportive therapy. There are no antimicrobials that cure the infection in dogs, although combination treatment with trimethoprim-sulfadiazine, clindamycin, and pyrimethamine followed by prolonged therapy with decoquinate diminishes clinical disease. Additionally, supportive care (including ensuring adequate hydration and providing pain relief) is recommended. Methods to prevent ACH include routine application of effective acaricides, prompt removal of attached ticks found on pets, and preventing dogs from roaming or engaging in predatory behavior to prevent ingestion of ticks on prey species.

Livestock and Wildlife Concerns: Extensive parasitism of cattle by Gulf Coast ticks can cause measurable weight and blood loss. Through laboratory experiments, Gulf Coast ticks were shown capable of transmitting *Leptospira pomona* to livestock. Gulf Coast ticks are also known vectors of the causative

agent of Heartwater, *Ehrlichia ruminantium*, a Foreign Animal Disease reportable in New Jersey. Although Heartwater has not been detected in the United States, the discovery of Gulf Coast ticks indicates a potential for disease establishment if introduced in the country. "Gotch ear" is another condition associated with feeding multiple Gulf Coast ticks in the inner and outer ears. The skin swells and cracks and becomes covered by a thick crust of serum, blood, and tick feces, causing animals to rub against inanimate objects, often causing further injury and, in some cases, there is extensive destruction of the supporting cartilage and the ear becomes drooped, thickened, curled, resulting in the condition known as Gotch's ear. The condition is described in cattle, although horses, mules, sheep, and goats may also develop this condition.

Gulf Coast ticks infected with *R. parkeri* have been collected from cattle, sheep, and goats, and from various species of wildlife, including black bears, feral pigs, white-tailed deer, cotton rats, and coyotes; but it is unknown if *R. parkeri* causes clinical disease in these animals.

NJDOH Tick Surveillance Program

Supported with federal grant funds, NJDOH began conducting surveillance for ticks of medical importance in New Jersey in 2019. NJDOH partners with several county mosquito control agencies, including the Salem County Mosquito Control program, to collect ticks, document their presence in counties around the state, estimate their density, and understand what human health pathogens they are carrying. Data from this program will be used to better characterize tickborne disease risk, monitor trends and changing patterns over time, and better inform health education efforts for healthcare providers and the public to prevent and diagnose tickborne disease infections.

Salem County Mosquito Control program staff identified a Gulf Coast tick on June 27th , which was morphologically confirmed by NJDOH staff. Subsequent tick surveillance documented the first known established population of Gulf Coast ticks in N.J. While this is the first established population, the Gulf Coast tick is likely established elsewhere in N.J and isolated reports have been received from other parts of the state. Surveillance efforts continue to determine the distribution of the Gulf Coast tick in N.J. and testing for *R. parkeri* in ticks is underway at the Centers for Disease Control and Prevention (CDC).

Tick Bite Prevention

NJDOH has several online resources on preventing tick bites and tickborne disease as well as educational resources for healthcare providers that include free continuing medical education (CME) credits.

Individual tick testing is not recommended for guiding healthcare decisions. If a tick tests positive for a pathogen causing a tickborne disease, it didn't necessarily transmit that pathogen to a person, and if the tick tests negative for human pathogens, it doesn't mean another attached (undetected) infected tick didn't transmit an infection. Tick identification, however, can be helpful if symptoms of tickborne disease develop after a tick exposure. Knowing what kind of tick may have bit someone and the diseases it is known to carry could assist healthcare providers with diagnosis and treatment. No-cost online tick identification services are available through Rutgers University and the University of Rhode Island.

Resources:

- NJDOH Spotted Fever Group Rickettsioses
- CDC Spotted Fever Group Rickettsioses Information for Healthcare Providers
- CDC Rickettsia parkeri rickettsiosis
- Eschar-associated Rickettsiosis and Diagnostics
- Companion Animal Parasite Council- American Canine Hepatozoonosis
- NJDOH Veterinary Public Health
- NJDA Division of Animal Health
- Rutgers University NJ Ticks 4 Science
- University of Rhode Island TickSpotters
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