TICK-BORNE DISEASES IN MAINE

A Physician's Reference Manual

Deer Tick

Nymph

Adult Male

Adult Female

Dog Tick

Nymph

Adult Male

Adult Female

Lonestar Tick (CDC PHOTO)

Nymph

Adult Male

Adult Female

images not to scale

KNOW YOUR TICKS

Ticks are generally found in brushy or wooded areas, near the ground; they cannot jump or fly. Ticks are attracted to a variety of host factors including body heat and carbon dioxide. They will transfer to a potential host when one brushes directly against them and then seek a site for attachment.

DEER TICK

Ixodes scapularis
(also called blacklegged tick)

Diseases
Lyme disease, anaplasmosis, babesiosis

What bites
Nymph and adult females

When
Anytime temperatures are above freezing, greatest risk is spring through fall

Coloring
Adult females have a reddish-brown tear shaped body with dark brown hood

Size:
Nymphs: Poppy seed
Unfed Adults: Sesame seed

DOG TICK

Dermacentor variabilis
(also called wood ticks)

Diseases
Rocky Mountain spotted fever and tularemia

What bites
Adult females

When
April through August

Coloring
Adult females have a dark brown body with whitish markings on its hood

Size:
Unfed Adults:
Watermelon seed

LONESTAR TICK

Amblyomma americanum

Diseases
Ehrlichiosis

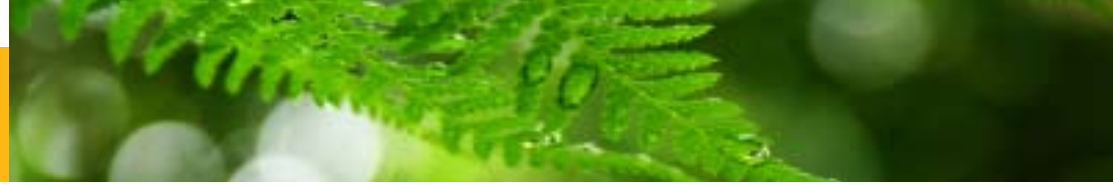
What bites
Nymph and adult females

When
April through September in New England, year-round in Southern US

Coloring
Adult females have a brown body with a white spot on the hood

Size:
Nymphs: Poppy seed
Unfed Adults: Sesame seed

SUMMER FEVER ALGORITHM



ALGORITHM FOR DIFFERENTIATING TICK-BORNE DISEASES IN MAINE

This algorithm is intended for use as a general guide when pursuing a diagnosis. It does not replace the physician's clinical judgment or the need for definitive laboratory testing.

Patient resides, works, or recreates in an area likely to have ticks and is exhibiting fever, headache, malaise and/or lymphadenopathy

Does the patient have a rash?

YES

Erythema migrans (single or multiple lesions)
Lyme disease

Maculopapular
May be anaplasmosis (rash is very uncommon), **further tests needed**

Cutaneous ulcer
May be tularemia (ulceroglandular), further tests needed

Maculopapular to Petechial*
May be RMSF, or ehrlichiosis, further tests needed
**If petechial rash of palm and sole (characteristic of RMSF) is present, treat immediately*

NO

Blood smear review

Parasites in RBC*
Babesiosis
**If patient has an international travel history, malaria should be ruled out*

Morulae in WBC
May be anaplasmosis (seen in less than 50% of serious cases), **further tests needed**

Complete blood count (CBC)

Normal CBC
May be Anaplasma, RMSF,* tularemia**
or Lyme disease, further tests needed
*****RMSF***—*thrombocytopenia may be observed*
******tularemia***—*WBC normal or elevated, thrombocytopenia may be observed*

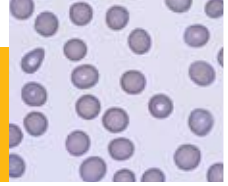
WBC low or normal, thrombocytopenia, low hematocrit, elevated reticulocytes
May be anaplasmosis or babesiosis, further tests needed

Normal hematocrit, thrombocytopenia, leukopenia
May be anaplasmosis or ehrlichiosis, further tests needed

OTHER CONSIDERATIONS

- Rash occurs in 70-80% of Lyme disease patients
- Rash occurs in less than 10% of anaplasma patients.
- Rash occurs in less than 40% of adult Ehrlichia patients, and less than 60% of children
- Rash occurs in 70-80% of RMSF patients but only appears several days after onset of febrile illness.
- Hyponatremia may occur with RMSF or tularemia.
- Lyme disease can present as Bell's palsy, further tests needed.
- Ulceroglandular tularemia usually presents as regional lymphadenopathy with a small ulceration distally, further tests needed.
- Coinfections involving Lyme disease, babesiosis, and/or anaplasmosis may occur because a single deer tick may carry multiple pathogens.
- Consider pneumonic tularemia in any patient presenting with community-acquired pneumonia who resides on, or has recently visited, Martha's Vineyard, Massachusetts.

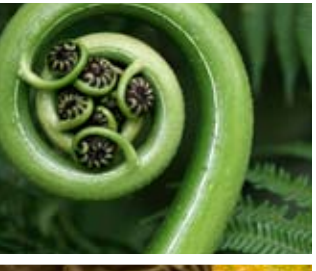
ANAPLASMOSIS (AKA HUMAN GRANULOCYTIC ANAPLASMOSIS)



AGENT

Bacteria: *Anaplasma phagocytophilum* (formerly *Ehrlichia phagocytophilum*)

Tick: *Ixodes scapularis*



SIGNS/SYMPTOMS

[Incubation Period 1-2 weeks]

- Fever, chills
- Severe headache
- Malaise
- Myalgia
- Gastrointestinal symptoms (nausea, vomiting, diarrhea, anorexia)
- Cough
- Arthralgia
- Stiff neck
- Confusion

LABS

Common Findings on Routine Laboratory Tests

Generally observed during the first week of clinical disease

- Mild anemia
- Thrombocytopenia
- Leukopenia (characterized by relative and absolute lymphopenia and a left shift)
- Modest elevations in hepatic transaminases

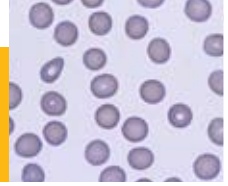
Diagnostic Laboratory Criteria

- Detection of DNA by PCR assay **(preferred method)**; or
- Demonstration of a four-fold change in IgG-specific antibody titer by IFA in paired serum samples; or
- Immunohistochemistry (IHC) staining of organism; or
- Isolation of organism from a clinical specimen in cell culture.

NOTES

- Visualization of morulae in the cytoplasm of neutrophils or eosinophils during examination of blood smears is highly suggestive of a diagnosis; however, blood smear examination is insensitive and should never be relied upon solely to rule anaplamsa in or out.
- Confirmation of the diagnosis is based on laboratory testing, but antibiotic therapy should not be delayed in a patient with a suggestive clinical presentation.
- Clinical signs of anaplasmosis and ehrlichiosis are similar, and testing for both species is indicated due to presence of both tick vectors. Also consider the possibility of coinfection with *B. microti* and/or *B. burgdorferi*.

ANAPLASMOSIS



TREATMENT

The regimens listed below are guidelines only and may need to be adjusted depending on a patient's age, medical history, underlying health conditions, pregnancy status or allergies. Consult an infectious disease specialist for the most current treatment guidelines or for individual patient treatment decisions.†

AGE CATEGORY	DRUG	DOSAGE	MAXIMUM	DURATION (DAYS)
Adults	Doxycycline	100 mg twice per day orally or IV	N/A	10
Children 8 years of age or older moderate illness	Doxycycline	4 mg/kg per day orally or IV in 2 divided doses	100 mg per dose	10
Children less than 8 years of age severe illness without Lyme disease	Doxycycline	4 mg/kg per day orally or IV in 2 divided doses	100 mg per dose	4-5 OR approx. 3 days after resolution of fever
Children less than 8 years of age severe illness with Lyme disease	Doxycycline	4 mg/kg per day given orally or IV in 2 divided doses	100 mg per dose	4-5
	FOLLOWED BY			
	Amoxicillin	50 mg/kg per day in 3 divided doses	500 mg per dose	to complete a 14 day total course of antibiotic therapy
	OR			
	Cefuroxime axetil	30 mg/kg per day in 2 divided doses	500 mg per dose	to complete a 14 day total course of antibiotic therapy

NOTES

- Patients with mild illness for whom doxycycline treatment is contraindicated may be treated with rifampin for 7-10 days using a dosage regimen of 300 mg twice per day by mouth for adults and 10 mg/kg twice per day for children (maximum, 300 mg per dose).
- Because anaplasmosis can be life-threatening and limited courses of therapy do not pose a substantial risk for tooth staining, the American Academy of Pediatrics has identified doxycycline as the drug of choice for treating anaplasmosis in children of any age.
- Treatment response is expected within 48 hours. Failure to respond in 3 days suggests infection with a different agent.
- Treatment is not recommended for asymptomatic individuals who are seropositive for antibodies to *A. phagocytophilum*.

REFERENCES

American Academy of Pediatrics. Ehrlichia and Anaplasma In: Pickering LK, Baker CJ, Long SS, McMillan JA, eds. Red Book: 2009 Report of the Committee on Infectious Diseases. 28th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2009: 284-287.

Bakken JS, Aguero-Rosenfeld ME, Tilden RL, et al. Serial Measurements of Hematologic Counts during the Active Phase of Human Granulocytic Ehrlichiosis. Clinical Infectious Diseases. 2001; 32: 862-870.

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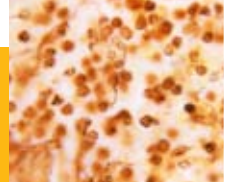
Centers for Disease Control and Prevention. Case Definitions for Infectious Conditions Under Public Health Surveillance. http://www.cdc.gov/ncphi/disss/nndss/casedef/case_definitions.htm. Accessed 12/10/2009.

Dumler JS, Walker DH. *Ehrlichia chaffeensis* (human monocytotropic ehrlichiosis), *Anaplasma phagocytophilum* (human granulocytotropic anaplasmosis) and Other Ehrlichiae. In: Mandell GL, Bennett JE, Dolin R, editors. Manell, Douglas, and Bennett's Principles and Practice of Infectious Diseases. 7th ed. Philadelphia, PA: Churchill Livingstone; 2010. p. 2531-2538.

†Wormser GP, Dattwyler RJ, Shapiro ED, et al. The Clinical Assessment, Treatment and Prevention of Lyme Disease, Human Granulocytic Anaplasmosis, and Babesiosis. Clinical Practice Guidelines by the Infectious Diseases Society of America. Clinical Infectious Diseases. 2006; 43: 1089-1134.

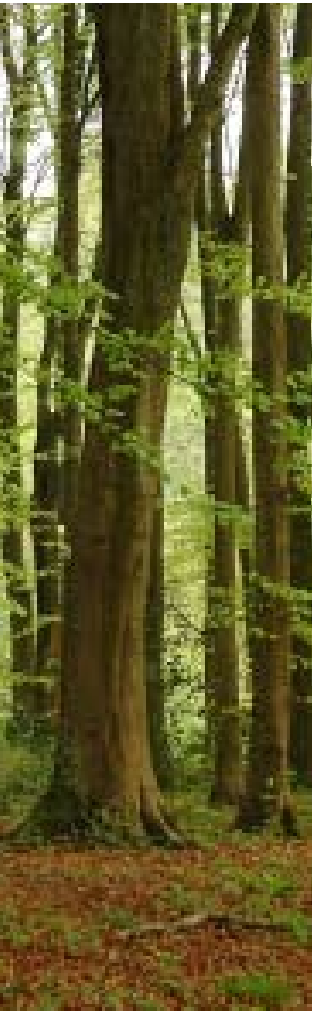
BABESIOSIS



AGENT

Parasite: *Babesia microti*

Tick: *Ixodes scapularis*



SIGNS/SYMPTOMS

[incubation period: 1-6 weeks]

- Malaise, fatigue
- Sustained or intermittent fever, chills
- Gastrointestinal symptoms (anorexia, nausea, abdominal pain, vomiting)
- Myalgia
- Arthralgia
- Depression, emotional lability
- Photophobia
- Conjunctival injection
- Dark urine
- Petechiae, splinter hemorrhages, ecchymoses
- Mild splenomegaly and/or hepatomegaly
- Cough
- Sore throat

LABS

Common Findings on Routine Laboratory Tests

- Decreased hematocrit secondary to hemolytic anemia
- Elevated reticulocyte counts
- Elevated erythrocyte sedimentation rate
- Thrombocytopenia
- WBC count may be normal or mildly decreased
- Decreased serum haptoglobin
- Elevated serum BUN and creatinine
- Mildly elevated hepatic transaminases
- Proteinuria
- Hemoglobinuria
- Direct Coombs' test may react positively

Diagnostic Laboratory Criteria

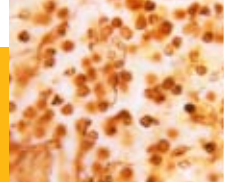
- Positive PCR assay **(preferred method)**; or
- Identification of intraerythrocytic Babesia parasites in a peripheral blood smear or
- Isolation of the parasite from a whole blood specimen by animal inoculation.

NOTE: Due to the sparse parasitemia typical of most *Babesia microti* infections, additional diagnostic tests should be performed in suspect patients if the initial blood smear is negative.

Supportive Laboratory Criteria

- Demonstration of a Babesia-specific antibody titer by Immunoflourescent Antibody (IFA) test for IgG. In general, higher cutoff titers ($\geq$ 1:256) are associated with greater diagnostic specificity.

BABESIOSIS



TREATMENT

The regimens listed below are guidelines only and may need to be adjusted depending on a patient's age, medical history, underlying health conditions, pregnancy status or allergies. Consult an infectious disease specialist for the most current treatment guidelines or for individual patient treatment decisions.†

AGE CATEGORY	DRUG	DOSAGE	MAXIMUM	DURATION (DAYS)
Adults	Atovaquone	750 mg orally every 12 hours	N/A	7-10
	PLUS			
	Azithromycin	500-1000 mg on day 1 and 250 mg orally once per day thereafter	100 mg per dose	7-10
	OR			
	Clindamycin	300-600 mg IV every 6 hours OR 600 mg orally every 8 hours	N/A	7-10
	PLUS			
	Quinine	650 mg orally every 6-8 hours	100 mg per dose	7-10
Children	Atovaquone	20 mg/kg every 12 hours	750 mg per dose	7-10
	PLUS			
	Azithromycin	10 mg/kg once per day on day 1 and 5 mg/kg once per day thereafter orally	500 mg per dose on day 1 and 250 mg per dose thereafter	7-10
	OR			
	Clindamycin	7-10 mg/kg IV or orally every 6-8 hours	600 mg per dose	7-10
	PLUS			
	Quinine	8 mg/kg orally every 8 hours	650 mg per dose	7-10

NOTES

- For adult patients who are immunocompromised, higher doses of azithromycin, 600-1000 mg per day, may be used.
- The recommended treatment for patients with severe babesiosis, as indicated by high-grade parasitemia (=> 10%), significant hemolysis, or renal, hepatic or pulmonary compromise, is quinine and IV clindamycin, and the patient should be considered for partial or complete RBC exchange transfusion
- Consider the possibility of coinfection with *B. burgdorferi* and/or *A. phagocytophilum* in patients with especially severe or persistent symptoms, despite appropriate antibabesial therapy.
- Asymptomatic patients with a positive babesial smear and/or PCR results should have these studies repeated. Treatment should be considered if parasitemia persists for more than three months.

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American Academy of Pediatrics. Babesiosis In: Pickering LK, Baker CJ, Long SS, McMillan JA, eds. Red Book: 2009 Report of the Committee on Infectious Diseases. 28th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2009: 226-227.

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†Wormser GP, Dattwyler RJ, Shapiro ED, et al. The Clinical Assessment, Treatment and Prevention of Lyme Disease, Human Granulocytic Anaplasmosis, and Babesiosis. Clinical Practice Guidelines by the Infectious Diseases Society of America. Clinical Infectious Diseases. 2006; 43: 1089-1134.

EHRLICHIOSIS (AKA HUMAN MONOCYTIC EHRLICHIOSIS)

AGENT

Bacteria: *Ehrlichia chaffeensis* (formerly *Ehrlichia phagocytophilum*)

Tick: *Ambylomma americanum*

SIGNS/SYMPTOMS

[Incubation period 7-10 days]

- Fever, chills
- Severe headache
- Malaise
- Myalgia
- Gastrointestinal symptoms (nausea, vomiting, diarrhea, anorexia)
- Cough
- Arthralgia
- Stiff neck
- Confusion

LABS

Common Findings on Routine Laboratory Tests

Generally observed during the first week of clinical disease

- Thrombocytopenia
- Mild to moderate leukopenia
- Modest elevations in hepatic transaminases

Diagnostic Laboratory Criteria

- Detection of DNA by PCR assay **(preferred method)**; or
- Demonstration of a four-fold change in IgG-specific antibody titer by IFA in paired serum samples; or
- Immunohistochemistry (IHC) staining of organism; or
- Isolation of organism from a clinical specimen in cell culture.

NOTES

- Confirmation of the diagnosis is based on laboratory testing, but antibiotic therapy should not be delayed in a patient with a suggestive clinical presentation.
- Clinical signs of anaplasmosis and ehrlichiosis are similar, and testing for both species are indicated due to presence of both tick vectors. Also consider the possibility of coinfection with *B. microti* and/or *B. burgdorferi*.

EHRLICHIOSIS

TREATMENT

The regimens listed below are guidelines only and may need to be adjusted depending on a patient's age, medical history, underlying health conditions, pregnancy status or allergies. Consult an infectious disease specialist for the most current treatment guidelines or for individual patient treatment decisions.†

AGE CATEGORY	DRUG	DOSAGE	MAXIMUM	DURATION (DAYS)
Adults	Doxycycline	100 mg twice per day orally or IV	N/A	10
Children 8 years of age or older moderate illness	Doxycycline	4 mg/kg per day orally or IV in 2 divided doses	100 mg per dose	10
Children less than 8 years of age severe illness without Lyme disease	Doxycycline	4 mg/kg per day orally or IV in 2 divided doses	100 mg per dose	4-5 OR approx. 3 days after resolution of fever
Children less than 8 years of age severe illness with Lyme disease	Doxycycline	4 mg/kg per day given orally or IV in 2 divided doses	100 mg per dose	4-5
	FOLLOWED BY			
	Amoxicillin	50 mg/kg per day in 3 divided doses	500 mg per dose	to complete a 14 day total course of antibiotic therapy
	OR			
	Cefuroxime axetil	30 mg/kg per day in 2 divided doses	500 mg per dose	to complete a 14 day total course of antibiotic therapy

NOTES

- Patients with mild illness for whom doxycycline treatment is contraindicated may be treated with rifampin for 7-10 days using a dosage regimen of 300 mg twice per day by mouth for adults and 10 mg/kg twice per day for children (maximum, 300 mg per dose).
- Because ehrlichiosis can be life-threatening and limited courses of therapy do not pose a substantial risk for tooth staining, the American Academy of Pediatrics has identified doxycycline as the drug of choice for treating ehrichiosis in children of any age.
- Treatment response is expected within 48 hours. Failure to respond in 3 days suggests infection with a different agent.
- Treatment is not recommended for asymptomatic individuals who are seropositive for antibodies to *E. chaffeensis.*

REFERENCES

American Academy of Pediatrics. Ehrlichia and Anaplasma In: Pickering LK, Baker CJ, Long SS, McMillan JA, eds. Red Book: 2009 Report of the Committee on Infectious Diseases. 28th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2009: 284-287.

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Dumler JS, Walker DH. *Ehrlichia chaffeensis* (human monocytotropic ehrlichiosis), *Anaplasma phagocytophilum* (human granulocytotropic anaplasmosis) and other ehrlichiae. In: Mandell GL, Bennett JE, Dolin R, editors. Manell, Douglas, and Bennett's Principles and Practice of Infectious Diseases. 7th ed. Philadelphia, PA: Churchill Livingstone; 2010. p. 2531-2538.

†Wormser GP, Dattwyler RJ, Shapiro ED, et al. The Clinical Assessment, Treatment and Prevention of Lyme Disease, Human Granulocytic Anaplasmosis, and Babesiosis. Clinical Practice Guidelines by the Infectious Diseases Society of America. Clinical Infectious Diseases. 2006; 43: 1089-1134.

LYME DISEASE




AGENT

Bacteria: *Borrelia burgdorferi*

Tick: *Ixodes scapularis*

SIGNS/SYMPTOMS

Early localized stage (within 3-30 days post-exposure)

- Erythema migrans (EM) – red ring-like or homogenous expanding rash (this is a pathognomonic sign)
- Flu-like symptoms including malaise, fatigue, headache, fever, chills, myalgia, regional lymphadenopathy

Early disseminated stage (within days to weeks post-exposure)

- Severe malaise and fatigue
- Multiple secondary annular rashes
- Regional or generalized lymphadenopathy
- Migratory pain in joints, tendons, bursae, muscle and bone
- Transient, migratory arthritis
- Atrioventricular nodal block
- Myopericarditis
- Meningitis, motor and sensory radiculoneuritis, subtle encephalitis, mononeuritis multiplex, pseudotumor cerebri
- Bell's palsy or other cranial nerve neuritis
- Splenomegaly
- Microsopic hematuria or proteinuria

Late disseminated stage (within months post-exposure)

- Prolonged episodes of arthritis
- Peripheral enthesopathy
- Chronic axonal polyradiculopathy
- Spastic parapareses
- Ataxic gait
- Chronic encephalomyelitis
- Subtle mental disorders
- Keratitis
- Fatigue

LABS

Common Findings on Routine Laboratory Tests

- Elevated sedimentation rate (generally with localized or early disseminated disease)
- For cases of Lyme disease meningitis, CSF typically has a lymphocytic pleocytosis with slightly elevated protein levels and normal glucose levels

Diagnostic Laboratory Criteria

- Demonstration of diagnostic IgM (in first 6 weeks ONLY) or IgG antibodies in serum or cerebrospinal fluid. Due to high false-positive rates in both enzyme immunoassay (EIA) and immunoflourescence assay (IFA) tests, a two-tier testing protocol is recommended; a positive or equivocal EIA or IFA should be followed by a Western blot **(preferred method)**

Limitations to Serologic Tests for Lyme Disease:

- Serologic tests are insensitive during the first few weeks of infection.
- In persons with illness > than 1 month, a positive IgM test alone is not recommended for determining current disease
- Due to antibody persistence, single positive serologic test results can not distinguish between active and past infection and serologic tests can not be used to measure treatment response.
- Due to their high sensitivity and low specificity, EIA and IFA tests may yield false-positive results due to cross-reactivity with antibodies to commensal or pathogenic spirochetes, certain viral infections (e.g., varicella, Epstein-Barr virus), or certain autoimmune diseases (e.g., systemic lupus erythematosus).

NOTE: Coinfection with B. microti and/or *A. phagocytophiuma* should be considered in patients who present with initial symptoms that are more severe than are commonly observed with Lyme disease alone, especially in those who have high-grade fever for more than 48 hours despite appropriate antibiotic therapy or who have unexplained leucopenia, thrombocytopenia, or anemia. Coinfection might also be considered in patients whose erythema migrans skin lesion has resolved but have persistent viral infection-like symptoms.

LYME DISEASE



TREATMENT

The regimens listed below are guidelines only and may need to be adjusted depending on a patient's age, medical history, underlying health conditions, pregnancy status or allergies. Consult an infectious disease specialist for the most current treatment guidelines or for individual patient treatment decisions.†

Early Localized Stage

AGE CATEGORY	DRUG	DOSAGE	MAXIMUM	DURATION (DAYS/ RANGE)
Adults	Doxycycline	100 mg twice per day orally or IV	N/A	14 (14-21)
	Cefuroxime axetil	500 mg twice per day	N/A	14 (14-21)
	Amoxicillin	500 mg 3 times per day	N/A	14 (14-21)
Children	Amoxicillin	50 mg/kg per day in 3 divided doses	500 mg per dose	14 (14-21)
	Doxycycline	4 mg/kg per day in 2 divided doses	100 mg per dose	14 (14-21)
	Cefuroxime axetil	30 mg/kg per day in 2 divided doses	500 mg per dose	14 (14-21)

NOTE: For patients intolerant of amoxicillin, doxycycline, and cefuroxime axetil, the macrolides azithromycin, clarithromycin, or erythromycin may be used, although they have a lower efficacy. Patients treated with macrolides should be closely observed to ensure resolution of clinical manifestations.

Treatment guidelines for patients with disseminated or late stage Lyme disease are outlined in the references.†

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American Academy of Pediatrics. Lyme disease (Lyme borreliosis, *Borrelia burgdorferi* infection). In: Pickering LK, Baker CJ, Long SS, McMillan JA, eds. Red Book: 2009 Report of the Committee on Infectious Diseases. 28th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2009: 430-435.

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ROCKY MOUNTAIN SPOTTED FEVER

AGENT

Bacteria: *Rickettsia rickettsii*

Tick: *Dermacentor variabilis*

SIGNS/SYMPTOMS

[incubation period 2-14 days]

- Fever, chills
- Severe headache
- Malaise
- Myalgia
- Gastrointestinal symptoms (nausea, vomiting, anorexia, abdominal pain, diarrhea, abdominal tenderness)
- Rash, 2-5 days after fever starts, begins as small, blanching, pink macules on the ankles, wrists, or forearms that evolve to muculopapules. May expand to the entire body including the palms and soles. The classic spotted, or generalized petechial, rash is not usually apparent until the 5th or 6th day of illness.
- Cough
- Conjunctival injection, +/-photophobia
- Altered mental status
- Focal neurologic deficits, including cranial or peripheral motor nerve paralysis or sudden transient deafness

NOTE: Rash may be completely absent or atypical in up to 20% of RMSF cases. Rocky Mountain "spotless" fever is more likely to occur in older patients.

LABS

Common Findings on Routine Laboratory Tests

- Anemia
- Thrombocytopenia
- Mildly elevated hepatic transaminase levels
- Hyponatremia
- Azotemia

Diagnostic Laboratory Criteria

- Detection of DNA in a clinical specimen by PCR assay (generally unreliable for acute blood samples) **(preferred method)**; or
- Demonstration of a four-fold change in IgG-specific antibody titer by IFA in paired sera; or
- IHC staining of organism in a biopsy or autopsy specimen; or
- Isolation of organism in cell culture.

NOTES

- Tests for IgM antibodies are generally not useful for serodiagnosis of acute disease, due to cross-reactivity and persistence of the antibody.
- Confirmation of the diagnosis is based on laboratory testing, but antibiotic therapy should not be delayed in a patient with a suggestive clinical presentation.

ROCKY MOUNTAIN SPOTTED FEVER

TREATMENT

The regimens listed below are guidelines only and may need to be adjusted depending on a patient's age, medical history, underlying health conditions, pregnancy status or allergies. Consult an infectious disease specialist for the most current treatment guidelines or for individual patient treatment decisions.†

AGE CATEGORY	DRUG	DOSAGE	MAXIMUM	DURATION (DAYS)
Adults	Doxycycline	100 mg twice daily, orally or IV	N/A	At least 3 days after the fever subsides and until evidence of clinical improvement is noted which is typically for a minimum total course of 5-7 days.
Children weighing =>100 lbs (45.4 kg)	Doxycycline	100 mg twice daily, orally or IV	Consult a pediatric infectious disease specialist	At least 3 days after the fever subsides and until evidence of clinical improvement is noted which is typically for a minimum total course of 5-7 days.
Children weighing < 100 lbs (45.4 kg)	Doxcycline	2.2 mg/kg body weight per dose twice daily, orally or IV	Consult a pediatric infectious disease specialist	At least 3 days after the fever subsides and until evidence of clinical improvement is noted which is typically for a minimum total course of 5-7 days.

NOTE: Because RMSF can be life-threatening and limited courses of therapy do not pose a substantial risk for tooth staining, the American Academy of Pediatrics has identified doxycycline as the drug of choice for treating RMSF in children of any age.

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TULAREMIA

AGENT

Bacteria: *Francisella tularensis*

Tick: *Dermacenter variabilis*

SIGNS/SYMPTOMS

[Average incubation period 3-5 days, range 1-21 days]

NOTE: The clinical presentation of tularemia will depend on a number of factors, including the portal of entry.

General (may be present in all forms of tularemia)

- Fever, chills
- Headache
- Malaise, fatigue
- Anorexia
- Myalgia
- Chest discomfort, cough
- Sore throat
- Vomiting, diarrhea
- Abdominal pain

Ulceroglandular

- Localized lymphadenopathy
- Cutaneous ulcer at infection site

Glandular

- Regional lymphadenopathy with no cutaneous lesion

Typhoidal

- Characterized by any combination of the general symptoms

Oculoglandular

- Photophobia
- Excessive lacrimation
- Conjunctivitis
- Preauricular, submandibular and cervical lymphadenopathy

Phyaryngeal

- Severe throat pain
- Cervical, preparotid, and retropharyngeal lymphadenopathy

Pneumonic

- Non-productive cough
- Substernal tightness
- Pleuritic chest pain

NOTE: Pneumonic tularemia should be considered in any patient presenting with community-acquired pneumonia who resides on, or has recently visited, Martha's Vineyard, Massachusetts.

LABS

Common Findings on Routine Laboratory Tests

- Leukocyte count and sedimentation rate may be normal or elevated
- Thrombocytopenia
- Hyponatremia
- Elevated hepatic transaminases
- Elevated creatine phosphokinase
- Myoglobinuria
- Sterile pyuria

Diagnostic Laboratory Criteria

- Demonstration of a four-fold change in antibody titer in paired sera; or
- Isolation of organism.

NOTE: Detection of organism by fluorescent assay or a single elevated serum antibody titer is supportive of the diagnosis; however, these results should be confirmed by either one of the methods above.

TULAREMIA

TREATMENT

The regimens listed below are guidelines only and may need to be adjusted depending on a patient's age, medical history, underlying health conditions, pregnancy status or allergies. Consult an infectious disease specialist for the most current treatment guidelines or for individual patient treatment decisions.†

AGE CATEGORY	DRUG	DOSAGE	MAXIMUM	DURATION (DAYS)
Adults	Gentamicin	5 mg/kg IM or IV daily (with desired peak serum levels of at least 5 mcg/mL)	N/A	10
	OR			
	Streptomycin	1 g IM twice daily	N/A	10
Children	Gentamicin	2.5 mg/kg IM or IV 3 times daily	Consult a pediatric infectious disease specialist	10
	OR			
	Streptomycin	15 mg/kg IM twice daily	2 g/day	10

NOTES

- Doses of both streptomycin and gentamicin need to be adjusted for renal insufficiency.
- Chloramphenicol may be added to streptomycin to treat meningitis.
- Alternative therapies to the preferred regimens of streptomycin and gentamicin are outlined in references.†

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ADDITIONAL RESOURCES

FOR MORE INFORMATION ON TICK-BORNE DISEASES OR TO REPORT A CASE OF TICK-BORNE DISEASE

Maine Center for Disease Control and Prevention
Infectious Disease Epidemiology
800-821-5821
www.mainepublichealth.gov

OTHER RESOURCES:

Centers for Disease Control and Prevention
www.cdc.gov

American College of Physicians/American Society of Internal Medicine
http://www.acponline.org/lyme/

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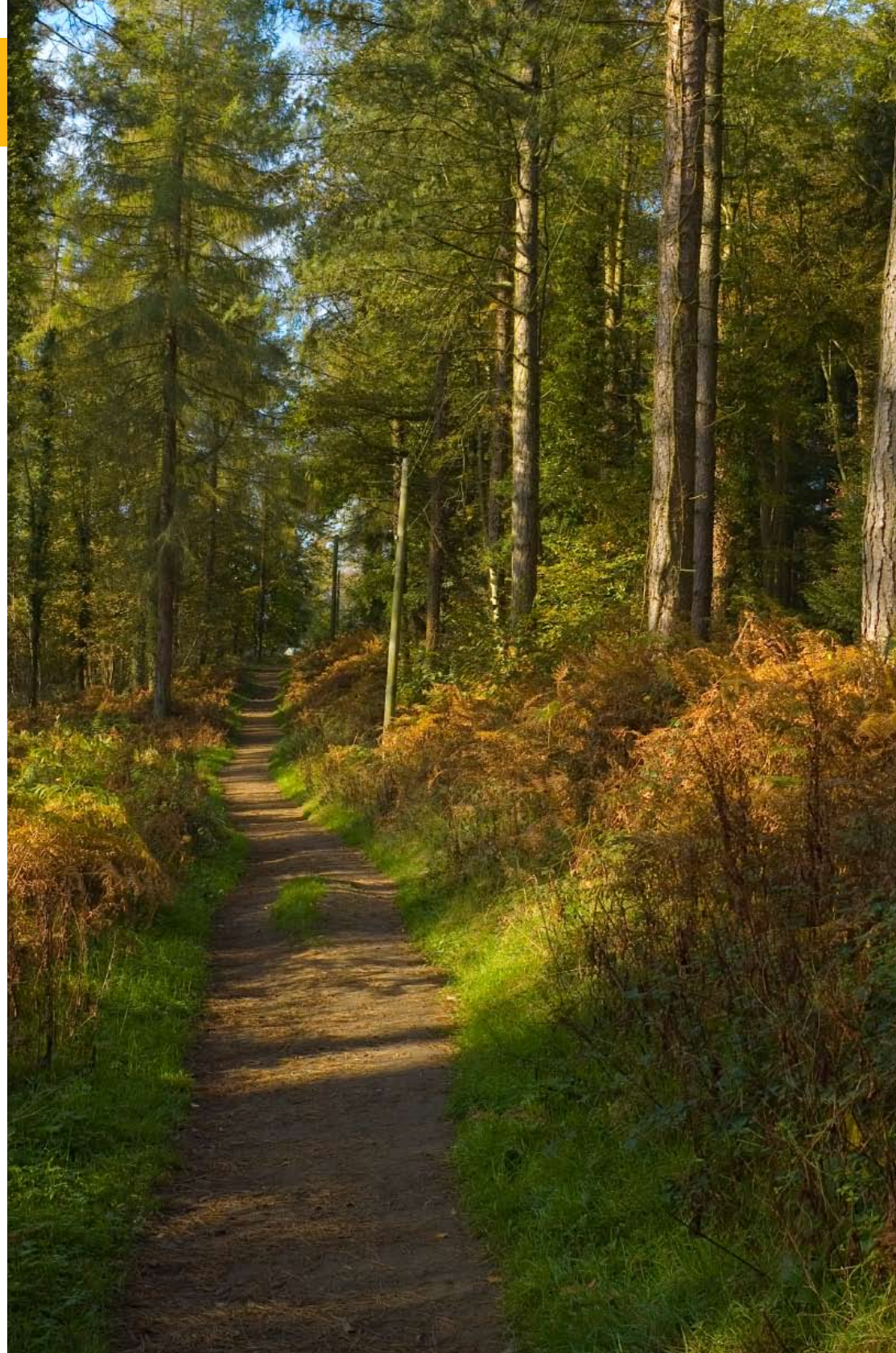

John E. Baldacci, Governor *Brenda M. Harvey, Commissioner*

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