Tick-Borne Disease- Diagnosis and Management

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Faculty Disclosure

• I have no financial relationships to disclose.

• There are no off-label or experimental medications or therapies in this lecture.
Learning Objectives

• Indicate and recognize the different types of tick-borne diseases.
• Define and discuss signs and symptoms of tick-borne diseases.
• Explain and compare the different types of testing for tick-borne diseases.
• Illustrate and discuss prophylactic treatment for certain tick-borne diseases.
• Identify and discuss the treatment and management for tick-borne diseases.
Preventing Ticks in the Yard

• Applying pesticides outdoors
  • Multiple companies offer solutions

• Create a Tick-Safe Zone
  • Remove leaf litter/ Mow lawn frequently
  • Clear tall grasses/bushes around houses
  • 3 ft barrier between grass and wooded areas
  • Keep playground equipment and patios away from yard edges/trees
  • Remove old furniture from the yard
Preventing Tick Bites on Pets

• Prevention products
  • Discuss with veterinarian
  • Don’t apply to cats - sensitive to multiple chemicals
• Check pets daily especially after being outdoors
• Remove ticks from their fur immediately
• Reduce tick habitat in your yard
Preventing Tick Bites

• Know where to expect ticks
  • Avoid wooded and brush areas with high grass/leaf litter
  • Walk in the center of trails

• Treat clothing and gear
  • Treat with 0.5% permethrin or purchase clothes with repellant

• Use EPA-registered insect repellents
  • Don’t use insect repellants on babies < 2 months old
  • Don’t use oil of lemon eucalyptus (OLE) or para-menthane-diol (PMD) on children < 3 years old
Preventing Tick Bites

• Check clothing for ticks
  • Tumble dry clothes for 10 minutes
  • Cold water doesn’t kill ticks

• Examine gear and pets

• Shower within 2 hours of being outside

• Conduct full body check
  • Under arms, umbilicus, back of knees, in hair, between legs, in and around ears.
Tick Bite: What to do?

• Remove the tick as soon as possible
  • Grasp the tick with fine tipped tweezers near skin
  • Pull upward with steady pressure. Don’t twist
  • Clean area with soap and water
  • Dispose of tick
  • Consider prophylaxis for Lyme
Tick-borne Diseases - United States

- Lyme Disease
- Babesiosis
- Erlichiosis
- Anaplasmosis
- Rocky Mountain Spotted Fever (RMSF)
- Tularemia
Less Common Tick-borne Diseases - United States

- Colorado Tick Fever
- Heartland virus disease
- Powassan disease
- Rickettsiosis
- Tick Borne Relapsing Fever (TBRF)
- Bourbon virus
- STARI (Southern tick-associated rash illness)
Tick-borne Diseases - Abroad

- Lyme - Eastern/Central Europe and Northern Asia
- Tickborne encephalitis (TBE) - Europe and Asia
- Omsk Hemorrhagic fever (OHF) - Western Siberia
- Kyansanur forest disease - Southern India
- Crimean-Congo hemorrhagic fever - Eastern Europe, China, Africa and Middle East
Tick Borne Disease Incidence 2017

- Lyme Disease (confirmed and probable) - 42,743
- Anaplasmosis/Ehrlichiosis - 7,718
- Spotted Fever Rickettsiosis - 6,248
- Babesiosis - 2,368
- Tularemia - 239
- Powassan virus - 33

Total cases in 2017 - 59,349
Total cases in 2016 - 48,610
Lyme Disease

- 95% of cases in CT, DE, ME, MD, MA, MN, NH, NJ, NY, PA, RI, VT, VA, WI

Lyme Disease Incidence - 2017

Blacklegged Tick

Western Blacklegged Tick
Early Lyme Disease Symptoms

Agent - *Borrelia burgdorferi*
- Incubation period 3-30 days
- Malaise, Fatigue
- Myalgias
- Arthralgias
- Fever
- Headache
- Erythema Migrans (EM) -
  - Bull’s eye rash
  - Occurs in 70-80% of patients
Erythema Migrans Rashes

Bluish hue without central clearing

Red expanding lesion with crust

Photo courtesy of Yevgeniy Balagula

Photo courtesy of Bernard Cohen
Erythema Migrans Rashes

Red, oval-shaped plaque

Multiple red lesions with dusky centers

Photo courtesy of Alison Young

Photo courtesy of Bernard Cohen
Disseminated Lyme Manifestations

- Rheumatologic
  - Transient and migratory arthritis and effusions
- Cardiac
  - Conduction abnormalities - AV node block but any abnormality can be seen
  - Myocarditis, pericarditis
- Neurologic
  - Bell’s Palsy
  - Meningitis, encephalitis
  - Cognitive difficulties
- Other Manifestations
  - conjunctivitis, keratitis, uveitis, hepatitis
Lyme Prophylaxis

• Prophylaxis (Age > 8yrs):
  • Attached for >24 hours or engorged
  • Tick bite within 72 hours
  • Doxycycline 200 mg PO X 1 dose

• No recommendations for prophylaxis in less than 8 years old
  • CDC mentions 4.4mg/kg dose – IDSA guidelines pending
Testing for Lyme Disease

- Antibody testing (IgG, IgM)
  - Common test
  - 2-part testing - EIA then Western Blot if equivocal or positive
  - Needs 2-3 weeks for antibodies to develop
  - Single positive serologic test can’t distinguish between active or past infections

- PCR testing
  - 3-12 days after tick bite
  - Expensive (~$2000) not always covered by insurance
Treatment for Lyme

• Adults
  • Doxycycline 100 mg BID for 10-21 days*
  • Amoxicillin 500 mg TID for 14-21 days
  • Cefuroxime 500 mg BID for 14-21 days

• Children
  • Amoxicillin 50mg/kg TID for 14-21 days
  • Doxycycline 4mg/kg BID for 10-21 days*
    • Indicated for age > 8 but used for RMSF in children <8
  • Cefuroxime 30mg/kg BID for 14-21 days

* recent studies suggest a shorter course
Babesiosis

Most cases in Northeast and Upper Midwest US

Blacklegged Tick

Cases in 2014
Babesiosis

• Agent - *Babesia microti*
• Incubation period- 1-9 weeks
• Caused by parasite
  • Can be transmitted via blood products
  • Severe symptoms for asplenia, older patients, immunocompromised
• Symptoms
  • Fever, chills, sweats
  • Malaise, fatigue
  • Myalgia, arthralgia, headache
  • Anorexia, nausea, vomiting, abdominal pain
  • Dark urine
Babesiosis Testing

- Complete Blood Count (CBC)
  - Hemolytic anemia, Thrombocytopenia, Diagnosis by blood smear
- Chemistry
  - Increased creatinine and BUN
- Liver Function Tests
- PCR
- Antibody (IFA)
  - Supportive for diagnosis
  - Difficult to determine acute vs prior infection
Babesiosis Treatment

• Atrovaquone 750mg BID for 7-10 days AND
• Azithromycin 500-1000 mg QD for 7-10 days

Or

• Clindamycin 600mg Q8H for 7-10 days AND
• Quinine 650mg Q8H for 7-10 days
Ehrlichiosis

Oklahoma, Missouri, Arkansas with 35% of cases

Incidence in 2017

Cases per million

- 0
- 0.5–1.6
- 1.6–5.9
- 5.9+

Blacklegged Tick

Lone Star Tick
**Ehrlichiosis**

- **Agent** - *Ehrlichia chaffeensis, E. ewingii, E. muris eauclairensis*
- **Incubation period** - 5-14 days
- **Symptoms**
  - Fever, Chills
  - Headache
  - Muscle pain
  - Nausea, vomiting, diarrhea, anorexia
  - Altered mental status
  - Rash
- **Fatalities more common in children <10 and adults >70**
Ehrlichiosis Diagnosis and Treatment

• Complete Blood Count (CBC)
  • Thrombocytopenia, leukopenia, anemia

• Liver Function Tests

• Antibody tests- Frequently negative in the first 7-10 days

• PCR-most sensitive within 1 week

• Treatment
  • Doxycycline for both adults (100 mg BID) and children (2.2mg/kg BID) for at least 7 days.
  • Treat for at least 3 days after fever ends
Anaplasmosis

Cases in Northeastern and Upper Midwest US

Incidence in 2017

Blacklegged Tick

Western Blacklegged Tick
Anaplasmosis Symptoms

- Agent - *Anaplasmosis phagocytophilum*
- Incubation period - 5-14 days
- Co-infections with Lyme, Babesiosis, and Powassan virus
- Symptoms
  - Fever, chills, rigors
  - Headache
  - Malaise, myalgia
  - Nausea, vomiting, diarrhea, anorexia
  - Rash (<10%)
- Can be transmitted by blood products and ticks
Anaplasmosis Diagnosis and Treatment

• Complete blood count (CBC)
  • Anemia, thrombocytopenia, leukopenia
• Liver Function tests
• Antibody tests
  • IgM antibodies are less specific, 4-fold rise in IgG
• PCR testing
  • Most sensitive during first week of illness
• Treatment
  • Doxycycline 10-14 days for both children (2.2mg/kg BID) and adults (100mg BID)
Rocky Mountain Spotted Fever

Cases in OK, NC, AR, TN, and MO account for 60% of cases

Incidence in 2017

American Dog Tick
Brown Dog Tick
Gulf Coast Tick
Rocky Mountain Wood Tick
Rocky Mountain Spotted Fever (RMSF)

- Agent - *Rickettsia rickettsii*
- Incubation period 3-12 days
- Early Symptoms
  - High fever, headache
  - Malaise, myalgia
  - Edema around eyes and on back of the hands
  - Nausea, vomiting, anorexia
- Rash - appears on wrists, forearms and ankles then spreads
  - Maculopapular rash
  - Occurs 2-5 days after onset of symptoms
  - 10% of patients don’t have a rash
Rocky Mountain Spotted Fever (RMSF)

• Late Symptoms
  • Altered mental status, coma, cerebral edema
  • Pulmonary edema, ARDS
  • Extremity necrosis
  • Multi-system organ failure
  • Rash: Petechiae
    • Usually not seen until day 6

• Can be fatal if not treated within the first 5 days
Rocky Mountain Spotted Fever Diagnosis and Treatment (RMSF)

- CBC: Thrombocytopenia
- Chemistry: Hyponatremia
- Liver function tests: Elevated
- Antibody Tests
  - May be negative in first 7-10 days of illness
- PCR testing for skin biopsy or whole blood
- Treatment
  - Doxycycline for children (2.2 mg/kg BID) and adults (100 mg BID) and treated for at least 3 days after fever subsides.
Tularemia

Incidence in 2017

1 dot placed randomly within county of residence for each reported case

Lone Star Tick
American Dog Tick
Rocky Mountain Wood Tick
Tularemia Symptoms

- **Agent** - *Francisella tularensis*
- **Incubation period** - 3-5 days
- **Symptoms**
  - Fever, chills.
  - Headache
  - Malaise, fatigue
  - Myalgia
  - Chest discomfort, cough
  - Sore throat
  - Vomiting, diarrhea
  - Cutaneous ulcer at site (not always present)

An ulcer caused by *Francisella tularensis*. 
Tularemia Testing and Treatment

- CBC - Thrombocytopenia
- Chemistry - Hyponatremia, elevated CPK
- Elevated LFTs
- Isolation of bacteria, antibody testing, or PCR testing

- Streptomycin 1g IM BID (children 15mg/kg) for minimum 10 days
- Doxycycline 100 mg IV or PO BID for 14-21 days
Take Home Points

• Prevent tick bites by making a tick-free zone in your yard
• Use EPA registered insect repellents
• Full body check after being in the woods.
• Remove a tick as soon as you find it and consider Lyme prophylaxis in certain situations.
• Treatment of choice for Lyme, Anaplasmosis, Ehrlichiosis, and RMSF is doxycycline.
• Antibody testing for certain tick-borne disease may be negative for the first 2 weeks.
• PCR testing can be used to give early diagnosis but can be expensive
References
