Tick-borne Infections

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National MOSQUITO Control Awareness Week 2019

Each year the week of June 26 is declared National Mosquito Control Awareness Week by the American Mosquito Control Association. AMCA's "Mosquito Week" educates the general public about the significance of mosquitoes in their daily lives and the important service provided by mosquito control workers throughout the United States and worldwide.

NATIONAL MOSQUITO CONTROL AWARENESS WEEK 2019 | JUNE 23-29, 2019
Disclosures

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• I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation.

Objectives

• Order the appropriate serologic studies when managing a patient with a tick-borne illness

Image courtesy of CDC
Rationale

• Tickborne infections are common in many geographic areas
• Tickborne infections are increasing
• Patients travel so pediatricians need to be aware of these illnesses
• Laboratory studies are often sent by “Lyme” or other “Tick” specialists; we need to be able to interpret the results

Image courtesy of CDC

Ticks

• Obligate hematophagous arthropods
• Geographic distribution
• Tick dispersal: walk vs. rides
• Can’t see, use other senses
• Await on vegetation or attack

Image courtesy of CDC
Ticks and Disease

• As vectors, second only to mosquitoes globally
• In North America, most common vector
• Reservoirs: transovarian passage of pathogens

Diseases

• Bacteria: *Anaplasma*, *Borrelia*, *Ehrlichia*, *Rickettsia*, *Francisella*
• Viruses: Colorado tick fever, Heartland, Powassan
• Parasite: *Babesia*

Images courtesy of CDC
Ticks

- *Ixodes* – black legged
- *Dermacentor* – American dog
- *Amblyomma* – lone star
- *Rhipicephalus* – brown dog
- *Ornithodoros* – soft tick

Images courtesy of CDC

www.cdc.gov/ticks/tickborneDiseases/tickID.html

Ixodidae

- Hard ticks, 694 species
- Feed for days, but only once per stage
- Secrete cement, enzymes, etc
- Anesthetic in saliva, painless
- Enlarge, vomit and spit during feedings

Image courtesy of CDC
Ixodidae

- Wide variety of hosts
- Live in open environments
- Seasonal activity
- Life span months to 3 years
- Rickettsioses, Lyme, tularemia, anaplasmoisis, ehrlichioses, babesiosis, Colorado tick fever, and more

Argasidae

- Soft ticks, 177 species
- Feed briefly and often
- Limited hosts, often single species
- Live in sheltered environment
- Long lives, up to 10 years
- Relapsing fever
Tick Control

- Habitat modification: difficult, risky
- Avoid tick bites
- Avoid tick habitats
- Long sleeves, tuck in pant legs
- Tick repellent: DEET, permethrin
- Tick-free pets

Images courtesy of CDC
www.cdc.gov/ticks/avoid/index.html

Tick Removal - NOT

- Alcohol
- Cigarette
- Match
- Nail polish
- Petroleum jelly

Images courtesy of CDC
**Tick Removal - Yes**

- Grasp tick with forceps or covered fingers
- Pull up and out
- Leave parts behind

Images courtesy of CDC

www.cdc.gov/ticks/removing_a_tick.html

**Lyme Disease**

- Named after a town in Connecticut
- Identified after reports from parents of several children with new onset juvenile rheumatoid arthritis
- Not Lyme’s or limes

Wormser et al. *Clin Infect Dis* 2006; 43: 1089
Clinical Manifestations

Early localized, Early disseminated, Late

www.cdc.gov/lyme/signs_symptoms/index.html Images courtesy of CDC

Early Localized

• Erythema migrans: starts at bite site, incubation about a week, red macule which expands to 5 cm or more, central clearing variable
• Flu-like illness common: fever, malaise, aches

Images courtesy of CDC and AAP
Early Disseminated

- Multiple erythema migrans
- Cranial nerve palsy: 7th is most common
- Meningitis
- Conjunctivitis
- Carditis
- Systemic symptoms common

Late Disease

- Arthritis: pauciarticular, knees most common
- Central nervous system: lymphocytic meningitis, radiculopathy

Images courtesy of CDC and AAP
Epidemiology

• Northeast: Maine to Virginia
• Most common, mice reservoir
• Midwest: Wisconsin, Minnesota
• West: northern California
• Least common, lizard reservoir

Transmission

• Spirochete, *Borrelia burgdorferi* is in the tick gut
• *Ixodes scapularis, I. pacificus*
• Tick feeds >36 hours to transmit
• Larvae – not infected
• Nymphs – most likely to transmit
• Adults – prefer deer

Images courtesy of CDC
Diagnosis

• Clinical: erythema migrans stage
• Culture: not generally available
• Serology: difficult, 2 tiered standard
• Polymerase chain reaction
• Antigen detection: useless, avoid

Image courtesy of CDC

Serology

• Immunoglobulin M peaks 3 to 6 wks and often lasts for months to years
• Immunoglobulin G peaks a bit later
• IgG lasts for years but is not protective
• Western blot: confirmatory
• Early therapy may abort response
Serology

- Early disseminated and late disease almost always seropositive
- False positives are extremely common
- Serial antibody testing is NOT helpful
- Diagnosing a second episode is almost impossible using serology

Treatment

<table>
<thead>
<tr>
<th>Disease category</th>
<th>Drug(s)</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Early localized</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erythema migrans</td>
<td>Doxycycline OR Amoxicillin OR Cefuroxime</td>
<td>10-14 d</td>
</tr>
<tr>
<td><strong>Extracutaneous</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolated facial palsy</td>
<td>Doxycycline</td>
<td>14 d</td>
</tr>
<tr>
<td>Arthritis</td>
<td>Doxycycline OR Amoxicillin OR Cefuroxime</td>
<td>28 d</td>
</tr>
<tr>
<td>Persistent arthritis</td>
<td>Retreat OR Ceftriaxone</td>
<td>14-28 d</td>
</tr>
<tr>
<td>Heart block or carditis</td>
<td>Doxycycline OR Amoxicillin OR Cefuroxime OR Ceftriaxone</td>
<td>14-21 d</td>
</tr>
<tr>
<td>Meningitis</td>
<td>Doxycycline OR Ceftriaxone</td>
<td>14 d</td>
</tr>
</tbody>
</table>

2018 Red Book Lyme Disease
Persistence of Symptoms

- Does not mean antibiotic failure
- No documented resistant pathogens
- More antibiotic therapy NOT useful
- Nonsteroidal anti-inflammatory agents often helpful
- Serial serology NEVER useful

Prevention

- Avoid tick bite
- Chemoprophylaxis
- Vaccine withdrawn

Images courtesy of CDC
Lyme Take Home

- A clinical diagnosis is required
- Serology often not needed or confusing
- Follow up serology rarely helpful
- Symptoms often persist
- More antibiotics is not better

New Guidelines

- Infectious Diseases Society of America, American Academy of Neurology, and American College of Rheumatology: Draft 6/25/19
- https://view.protectedpdf.com/ad6GFZ
Rocky Mountain Spotted Fever

- Highest incidence: AR DE MO NC OK TN
- Clinical: Fever, myalgia, headache, vomiting, peripheral to central rash
- *Rickettsia rickettsii*
- Dog ticks: *Dermacentor variabilis, Rhipicephalus sanguineus*; wood tick *D. andersoni*

Images courtesy of CDC  [www.cdc.gov/rmsf/](http://www.cdc.gov/rmsf/)

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Rocky Mountain Spotted Fever

- Small vessel vasculitis
- Laboratory findings: low platelets, low serum sodium
- Diagnosis: clinical, serology to confirm
- Treatment: doxycycline, all ages
- Prevention: avoid ticks

*2018 Red Book RMSF*  
Images courtesy of CDC
Ehrlichioses

- Illness: fever, headache, myalgia, rash
- *Ehrlichia chaffeensis*, *E. ewingii*
- *Amblyomma americanum* (lone star)
- Lab clues: elevated transaminases, thrombocytopenia, leukopenia
- Diagnosis: clinical, serology, PCR
- Therapy: doxycycline for all ages

www.cdc.gov/anaplasmosis/

Images courtesy of CDC

Anaplasmosis

- Illness: fever, headache, chills, myalgia
- *Anaplasma phagocytophilum*
- *Ixodes scapularis*, *I. pacificus*
- Lab clues: elevated transaminases, thrombocytopenia, leukopenia, morulae
- Diagnosis: clinical, serology, PCR
- Therapy: doxycycline for all ages

www.cdc.gov/anaplasmosis/

Images courtesy of CDC
Relapsing Fever

- Fever, chills, headache, myalgia, arthralgia, weakness
- First episode 3 days, relapse(s) milder
- Soft ticks: Western cabins, Texas caves
- *Borrelia hermsii, B. parkeri, B. turicatae*
- Rx: penicillin, doxycycline, erythromycin

www.cdc.gov/relapsing-fever/  Images courtesy of CDC

Tularemia

- Fever, chills, myalgia, headache
- Presentations: ulceroglandular, glandular, oculoglandular, oropharyngeal, typhoidal, intestinal, pneumatic

www.cdc.gov/Tularemia/
**Tularemia**

- Fever, chills, myalgia, headache
- Transmitted by ticks, deer flies, contact with infected rabbits and rodents
- Organism: *Francisella tularensis*
- Rx: aminoglycoside, doxycycline, cipro

www.cdc.gov/Tularemia/

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**Practice Change**

- Laboratory testing will be restricted to patients with history and symptoms suggestive of the infection
  
  *AKA*

- Just say NO: I will not test for “Limes disease” because the parent wants it
Tick Free?