Tick-borne Diseases

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Tick-borne Diseases

- Ehrlichiosis*
  - Human Monocytic Ehrlichiosis (HME)
  - Human Granulocytic Ehrlichiosis (HGE)
- Rocky Mountain Spotted Fever (RMSF)*
- Lyme Disease*
- Southern Tick-Associated rash illness (STARI)
- Babesiosis
- Tularemia*

*Reportable in VA
Ehrlichiosis

- Obligate intracellular, gram-negative cocci
- Two different bacteria causing similar syndromes
  - Human Monocytic Ehrlichiosis (HME)
    - Caused by *Ehrlichia chaffeensis*
    - Most frequently infects monocytes and macrophages
  - Human Granulocytic Ehrlichiosis (HGE)
    - Caused by *Anaplasma phagocytophila* (formerly *E. phagocytophila*)
    - Most frequently infects granulocytes (neutrophils and rarely eosinophils)
Ehrlichiossis - US Epidemiology

- 80-90% of all ehrlichiossis cases occur between April and September
- HME cases most frequently reported in Southeastern and Midwestern states
- Most HGE cases occur in states with high incidence of Lyme Disease
- Increased age – risk factor for disease
- Case-fatality rate: 2 - 3%
Areas where human ehrlichiosis may occur based on approximate distribution of vector tick species
Ehrlichiosis - Symptoms

- Incubation period: Initial symptoms begin 5-10 days
- Symptoms: Include fever, headache, muscle pain, vomiting, malaise
- Rash common in children with HME
- Severe illness can result in prolonged fever, renal failure, meningoencephalitis, coma
- Severity of symptoms may be related to immunostatus of patient
- Clinical laboratory findings include leukopenia, thrombocytopenia, elevated liver enzymes
Ehrlichiosis - Diagnosis

• Diagnosis:
  - Serology: Indirect Immunofluorescence Antibody (IFA)- 4x change in antibody titer between paired serum samples
    – Detection of *E. chaffeensis* OR *A. phagocytophila* DNA by Polymerase Chain Reaction (PCR)
    – Direct Isolation of agent – Cell Culture
    – Immunostaining of *E. chaffeensis* OR *A. phagocytophila* antigen
Ehrlichiosis - Treatment

- Should be initiated on suspicion of ehrlichiosis
- Doxycyclines or other tetracyclines
- Failure to respond to tetracyclines argues against diagnosis of Ehrlichiosis
Rocky Mountain Spotted Fever (RMSF) – US Epidemiology

- Caused by *Rickettsia rickettsii*, obligate intracellular bacterium
- Most cases occur in the South Atlantic (NC) and West Central states (AR)
- X > 90% of patients with RMSF are infected during April – September
- Children at higher risk - 2/3 reported cases occur in patients < 15 years of age
- Case-fatality: 1 - 5%
RMSF - Average annual incidence of Rocky Mountain spotted fever according to county in the United States, 1981–1992
RMSF - Symptoms

• Incubation period: Symptoms begin 2 to 9 days
• Symptoms: Fever, nausea, vomiting, muscle pain, severe headache, lack of appetite
• Rash: Maculopapular on extremities, 2-5 days
• Petechial exanthem occurs on or after 6th day
• As many as 10-15% of patients may never develop a rash
RMSF - Diagnosis & Treatment

- **Diagnosis**
  - Serological evidence of significant change in serum antibody titer reactive to *R. rickettsii*
  - Detection of *R. rickettsii* DNA by PCR
  - Direct Isolation of agent – Cell Culture
  - Immunostaining of *R. rickettsii* antigen

- **Treatment:**
  - Initiated upon suspicion of RMSF
  - Doxycycline
  - Failure to respond to tetracyclines argues against diagnosis of RMSF
  - Chloramphenicol - alternate drug
Lyme Disease – US Epidemiology

• First recognized among cluster of children believed to have juvenile rheumatoid arthritis in Lyme, CT, 1975

• *Borrelia burgdorferi*: Gram-negative, mobile spirochete

• Risk factors
  – Age < 14 yrs
  – Age > 40 yrs

• Onset typically during the summer months

•occurs in Northeast, mid-Atlantic, Northcentral, and along Pacific Coast
Incidence of Lyme Disease by County of Residence, U.S. 2002

* Per 100,000 population.
Lyme Disease - Symptoms

- Incubation period: 4 to 7 days (range 3 to 30 days)
- Symptoms:
  - Fever
  - Fatigue
  - Malaise
  - Headache
  - Muscle and joint aches
- Localized Infection: erythema migrans (EM) in 70-90% of cases
- Case-fatality: <1%
Lyme Disease – Later Stages

• Early disseminated infection – Several weeks to months after onset
  – Neuro: Meningitis, cranial neuropathy (includes facial palsy)
  – Cardio: myocarditis, heart block
  – Arthritis: migratory joint and muscle pains

• Late disseminated infection – Months to years after onset
  – Neuro: Encephalopathy, cognitive disorders
  – Arthritis: Chronic arthritis, prolonged arthritis attacks
Lyme Disease - Diagnosis

• In absence of EM, diagnosis can be difficult
• Antibodies usually detected 3-4 weeks after infection with ELISA or IFA

➤ Two-stage serological testing recommended:
  – If Negative: No further testing
  – If Positive or Equivocal- Western immunoblot to demonstrate antibody reaction to several *B. burgdorferi* antigens

• If patient with suspected early LD has negative serology, evidence of infection best obtained by testing paired acute- and convalescent-phase serum samples
Lyme Disease - Treatment

- Treatment: Appropriate to treat patients early based on clinical findings
- Several antibiotics including doxycycline, amoxicillin, penicillin, ceftriaxone, cefotaxime, or cefuroxime axetil
- Intravenous antibiotics for central nervous system involvement and recurrent arthritis
- Complications
  - Treatment-resistant Lyme arthritis associated with HLA-DRB1*0401, 0101 and other related alleles
  - Overtreatment: patients that have no evidence of Lyme disease are treated, report more adverse drug reactions
Reported Tick-borne Disease Cases in Virginia, 1995-2004

- Lyme Disease
- RMSF
- Ehrlichiosis Total

Year:
- 1995
- 1996
- 1997
- 1998
- 1999
- 2000
- 2001
- 2002
- 2003
- 2004

Cases:
- 0
- 50
- 100
- 150
- 200
- 250
- 300
## Tick-borne Diseases in Virginia, Cases by Age and Gender, 2004

<table>
<thead>
<tr>
<th>Disease</th>
<th>% Male</th>
<th>Median Age (Range) years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ehrlichiosis</td>
<td>71.4</td>
<td>41.0 (14 - 64)</td>
</tr>
<tr>
<td>RMSF</td>
<td>63.0</td>
<td>43.5 (8 – 75)</td>
</tr>
<tr>
<td>Lyme Disease</td>
<td>47.0</td>
<td>41.0 (1 - 86)</td>
</tr>
</tbody>
</table>
Seasonal Distribution of Tick-borne Diseases in Virginia, 2004

![Graph showing the seasonal distribution of tick-borne diseases in Virginia, 2004. The graph includes data on cases for various months and different diseases such as EHRLICHIOSIS, LYME, and RMSF. The highest number of cases is seen in June and July, with a peak in June.]
Tularemia

- Category A Agent
- Gram negative, intra- and extracellular coccobacillus
- Three main types:
  - *Francisella tularensis* biogroup *tularensis* – N. America; most virulent
  - *F. tularensis* biogroup *holartica* – Europe and Asia
  - *F. tularensis* biogroup *novicida* – US but low virulence
- Found in >250 animal species, including mammals and invertebrates
- Natural reservoirs: Rabbits and hares
- Severity of disease depends upon route of transmission
Tularemia - Routes of transmission

- Aerosol droplets
- Animal bites
- Arthropods: ticks, deerfly, various mosquito species
- Contaminated water
- Direct contact with animal product/infected dead animals (skinning rabbits)
- Eating undercooked infected meat
- Inhaling contaminated dust
Tularemia

- Incubation period: average 4-5 days, range 1-21 days
- Symptoms: chills, fever, body aches, headache
- Dependent upon route of exposure: ulcers, swollen lymph nodes, conjunctivitis, and sore throat may also develop
- Most acute form is associated with inhalation of bacteria-resulting in pneumonia
- Case-fatality: $x < 2\%$
Southern Tick-Associated Rash Illness (STARI)

- *Borrelia lonestari*-spirochete
- Southeastern and South-central states
- Following bite of lone star tick
- Incubation period: ~6 days
- Rash with central clearing; similar to that of Lyme disease
- Other symptoms: fatigue, headache, stiff neck, fever
Babesiosis

- Malaria-like illness caused by protozoa that infect RBCs
  - *Babesia microti* – Eastern and Midwestern USA
  - *B. divergens* – Europe
- Symptoms appear 1-6 weeks
- Fever, chills, fatigue, sweats, headache, muscle pains
- Complications include acute respiratory failure, congestive heart failure and renal failure
- Severe or fatal cases in the immunosuppressed and those without spleens
Prevention of Tick-borne Diseases

• Avoid tick-infested areas
• Wear light colored clothing
• Tuck pant legs into socks and boots
• Wear long-sleeved shirts that are buttoned at the wrists
• Use DEET
  – ≤50% for Adults
  – ≤30% for Children under 12
• Use permethrin-based mosquito and tick repellent (on clothing only)
Prevention of Tick-borne Diseases

- When hiking or walking, minimize contact with vegetation
- Walk within the center of mowed trails
- Perform a tick-check on yourself, your children and pets
- Use full-length mirror to check yourself
- Remove, wash and dry clothing
- Sooner you remove the ticks, the better
Prevention of Tick-borne Diseases: Tick Removal

- Use sharp-tipped tweezers or forceps
- Remove tick by grasping it as close to the skin as possibly. Pull it straight out, slowly and steadily.
- After tick is removed, wash your hands with soap and water. Apply antiseptic to bite site.
References and Photo Credits


Next, the Ticks . . .