‘ TIS THE SEASON: TICK-BORNE DISEASES

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Objectives

- Describe the recognition and management of **Lyme Disease, Rocky Mountain Spotted Fever** and **Ehrlichiosis**
- Describe the best practices for management of patients with **Tick Bites**
- Detail how to counsel patients regarding **Prevention of Tickborne Diseases** and **Tick Removal**

LYME DISEASE

Lyme Disease: Risk of Acquisition

- Most common reportable Tickborne Disease in U.S.
- 20,000-24,000 cases annually
- Overall risk 1-2%
- Risk increased with nymphal tick and engorgement at discovery
- 8-10% risk following bite by infected nymphal tick

N Engl J Med 1992; 327:1769-83

Stages of Lyme Disease

- **Early localized disease**

  Erythema migrans

- **Early disseminated and late disease**

  Multiple erythema migrans

  Isolated facial palsy

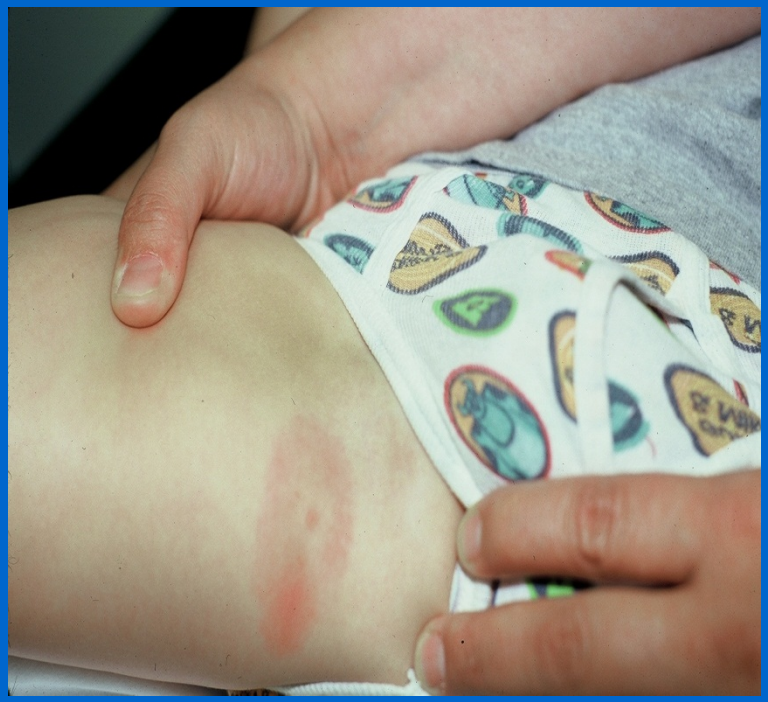
  Arthritis

  Carditis

  Meningitis

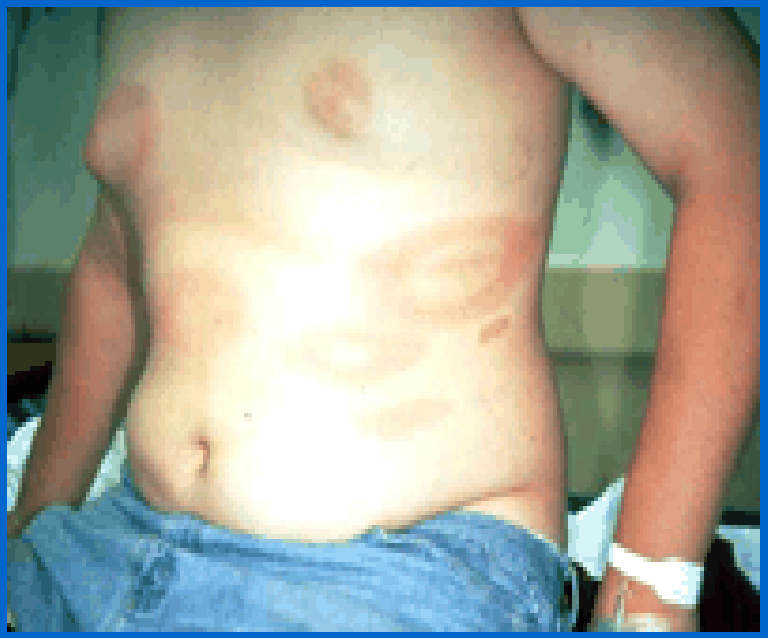
  Encephalitis, peripheral neuropathy, encephalopathy

Erythema Migrans Rash



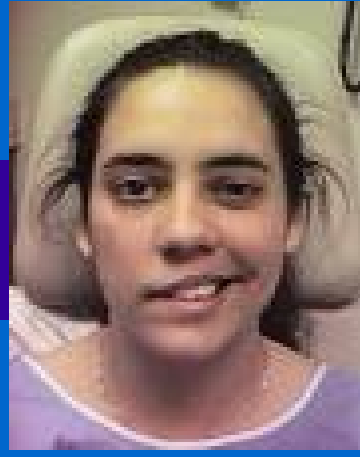
- Rash appears at site of tick bite 67-80%
- Erythematous macular rash - may have central clearing
- Flu-like symptoms

Early disseminated disease



- Multiple Erythema migrans lesions seen in 25% of patients

Lyme Disease: Neurologic Disease



- Cranial neuropathy
- Aseptic meningitis
- Pseudotumor cerebri
- Peripheral neuropathy
- Encephalitis

Lyme Neuroborreliosis

- Fever more common in viral meningitis
  (Pediatr. 1999. 103:657-60)
- Long duration of symptoms prior to LP supports Lyme meningitis (Pediatr. 1999. 103:657-60)
- Children with facial palsy appear to do well
- Neurocognitive function after treatment for Lyme disease appears to be excellent (Pediatr 1994; 94:185-89)

Lyme Disease: Arthritis

- Knee involved in 90% of cases
- Swollen, warm knee
- Better ROM and less pain than septic joint
- Resolves in 2-6 weeks with therapy
- Excellent prognosis (J Rheumatol. 2010. 37:1049-55)

Lyme Disease: Serodiagnosis

- Refrain from ordering tests for patients with nonspecific symptoms (i.e. fatigue or arthralgia)
- Do order tests when clinical signs suggest Lyme Disease (i.e. nerve palsy, arthritis)
- Two step method with Elisa and Western Blot
- C6 detects antibody to peptide of *B burdorferi* and appears equivalent to two step protocol
- PCR detects *B burdorferi* DNA in joint fluid
- Urinary antigen has no role in diagnosis

Lyme Disease: Management of the Child with a Tick Bite

- Prophylactic antibiotics not routinely indicated
- Risk of Lyme low after brief attachment (flat, non-engorged tick)
- Higher risk after engorgement and nymphal tick attached $\geq$ 36 hours
- Analyzing tick for spirochete infection has poor predictive value
- Ask parents to report any concerning symptoms
- Ask parents to look for a skin lesions at the site of the tick bite in 30 days

Lyme Disease: Chemoprophylaxis

- Prophylax for tick bite in hyperendemic area of infection (> 20% of ticks infected with Borrelia burgdorferi) :
- If engorged deer tick attached ≥ 36 hours
- If prophylaxis can be started within 72 hours of tick removal
- Consider Doxycycline for ≥ 8 years

  < 45 kg: Single dose 4.4 mg/kg

  ≥ 45 kg Single dose 200 mg
- **2012 Redbook. AAP Committee Infect Dis. Lyme Disease. p 479**

Lyme Disease Treatment:

Early Localized Disease

Erythema Migrans

> 8 yrs Doxycycline:

- 4 mg/kg/day divided BID (Max: 100 mg PO BID) for 14-21 days

< 8 yrs Amoxicillin:

- 50 mg/kg/day divided TID (Max: 500 mg PO TID) for 14-21 days **OR**

Cefuroxime:

- 30 mg/kg/day divided BID (Max: 500 mg PO BID)

- **2012 Redbook. AAP Committee Infect Dis. Lyme Disease. p 478**

Lyme Disease Treatment II

- **Multiple Erythema migrans**
  - Use oral regimen for Early Disease for 21 days
- **Isolated Bell's Palsy**
  - Use oral regimen for Early Disease if no signs of meningitis
  - Steroids contraindicated

  New onset arthritis in untreated patient
  - Use oral regimen for Early Disease for 28 days
- **2012 Redbook. AAP Committee Infect Dis. Lyme Disease. p 478**

Lyme Disease Treatment III

- **Persistent or Recurrent Arthritis**
  - Consider second course of oral agent for 28 days
  - IV Ceftriaxone 50-75 mg/kg IV daily (Max: 2 Grams per day for 14-28 days OR IV Penicillin or Cefotaxime
- **AV Block or Carditis**
  - Oral regimen if asymptomatic
  - IV Ceftriaxone or penicillin: syncope, chest pain
- **Meningitis**
  - IV Ceftriaxone or cefotaxime with alternative of penicillin for 14 days (range 10-28 days)
- **2012 Redbook. AAP Committee Infect Dis. Lyme Disease. p 478**

Lyme Disease Treatment IV

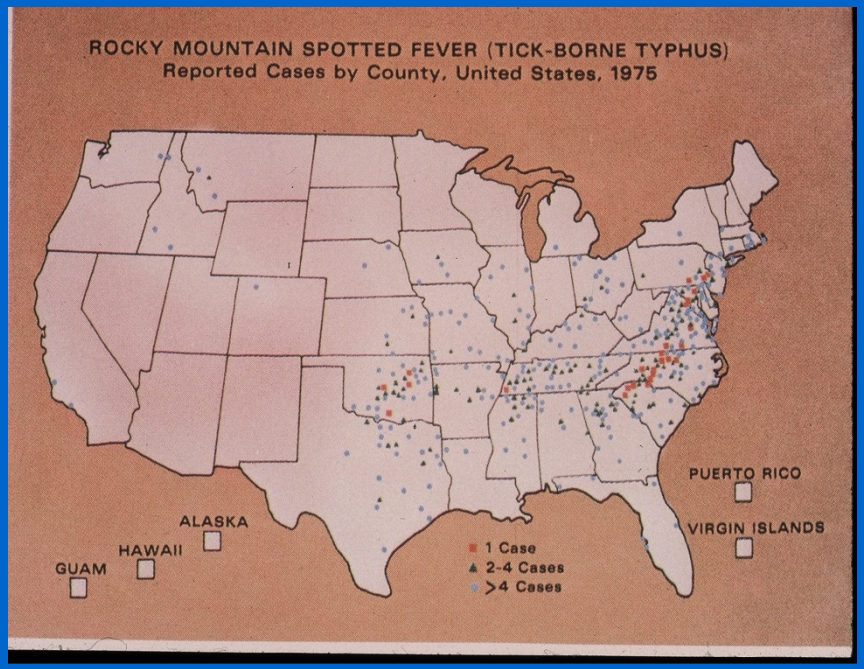
- **Encephalitis, Peripheral Neuropathy, Encephalopathy**

  - IV Ceftriaxone with alternative of IV penicillin or cefotaxime for 14-28 days

- **2012 Redbook. AAP Committee Infect Dis. Lyme Disease. p 478**

ROCKY MOUNTAIN SPOTTED FEVER

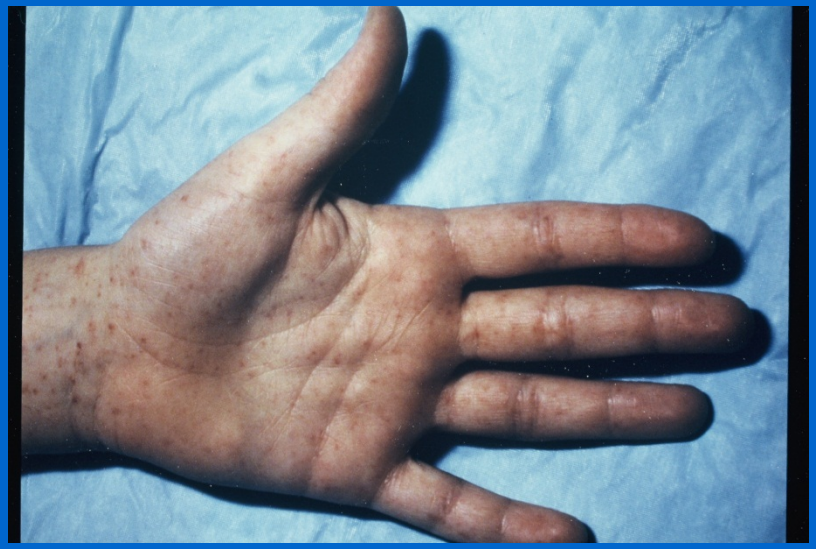
Rocky Mountain Spotted Fever



- Annually: 300-800 cases
- 2003-2005: 1,000-2,000
- Systemic, small vessel vasculitis caused by *Rickettsia rickettsii*
- Dog tick (Eastern US)
- Wood tick (Western US)
- Summer, Fall

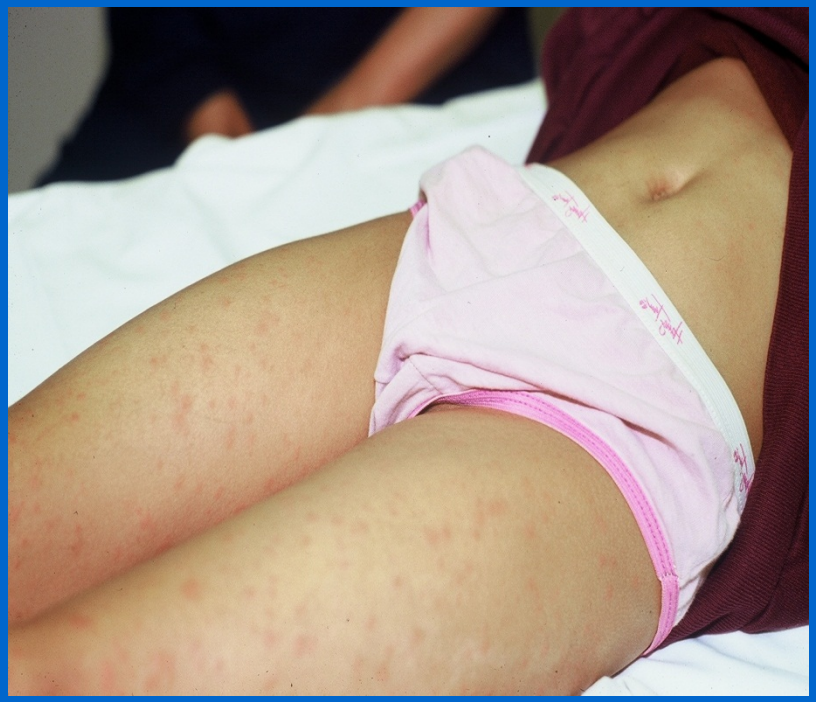
RMSF: Dog Ticks

RMSF: Presentation



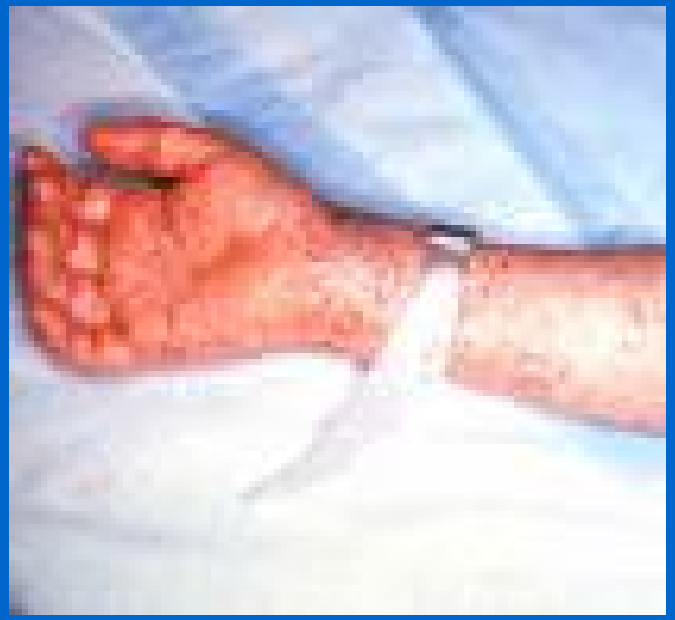
- Incubation period usually 7 days (2-14 days)
- History of tick bite unreliable (present 60% cases)
- Fever: 2-8 days post bite, abrupt rise to 40°C
- Rash: 2-3 days post fever

RMSF: Clinical Signs and Symptoms



- **Fever** to 40 degrees
- Rash: maculopapular, petechial, hemorrhagic
- Conjunctival inject
- Pneumonia
- Myalgias
- Headache,confusion,coma
- Myocarditis, acute renal failure, DIC, gangrene
- Case fatality rate of 5-25%

RMSF: Clinical and Laboratory Abnormalities



- Hyponatremia
- Leukopenia
- Thrombocytopenia

RMSF: Treatment

Doxycycline is drug of choice in patients of any age

- Less affinity for dental enamel than tetracycline
- Staining of dental enamel is dose dependent
- Treat until patient afebrile for 3 days (7 days usual course)
- Effective against Ehrlichiosis
- Does not have the serious adverse effects of chloramphenicol

EHRLICHIOSIS AND ANAPLASMOSIS

Ehrlichiosis and Anaplasmosis

- Bacteria of genus Ehrlichia and Anaplasma
- Similar to Rocky Mountain Spotted Fever
- Southeastern US; Lone Star Tick
- Flu-like illness: Fever, headache, myalgia
- Maculopapular rash in 50%
- Leukopenia, thrombocytopenia, hepatitis
- ARDS, encephalopathy, meningitis, renal failure
- Mortality: 1-3%

Ehrlichiosis and Anaplasmosis

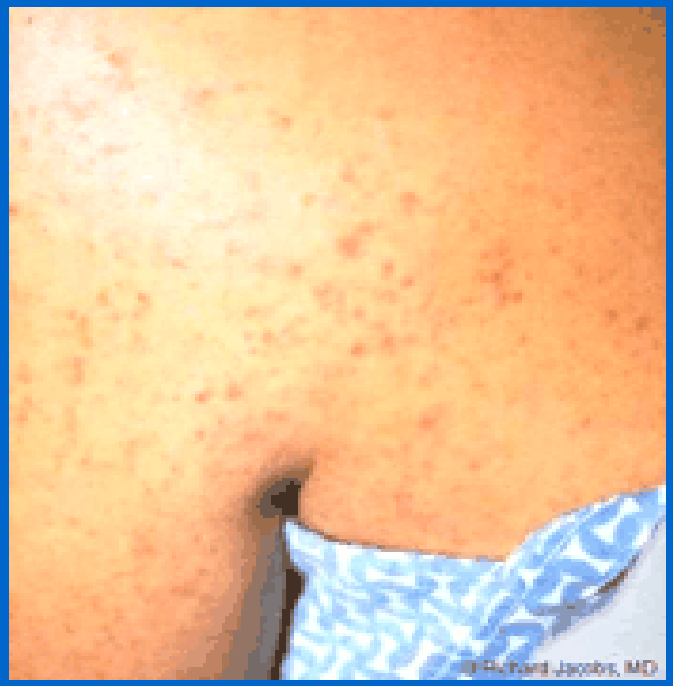
Disease	Causative Agent	Target Cell	Tick Vector	Geographic Distribution
Ehrlichiosis	***Ehrlichia chaffeensis***	**Monocytes**	**Lone Star Tick**	Southeast, south central, Midwest
Ehrlichiosis	***Ehrlichia ewingii***	**Granulocytes**	**Lone Star Tick**	Southeast, south central, Midwest
Ehrlichiosis	***Ehrlichia muris***	**Unknown**	**Deer Tick**	Minnesota, Wisconsin
Anaplasmosis	***Anaplasma phagocyto-philum***	**Granulocytes**	**Black-legged or deer tick or Western black-legged tick**	Northeast, north central, northern California

Ehrlichiosis and Anaplasmosis: Clinical Presentation

- Retrospective study
- Jan 1, 1990 –Dec 31, 2002
  32 patients: 6 SE US sites
  (NC, TN, KY, AR, MO)
- 7/32 (22%) required PICU
- 4/32 (13%) required mechanical ventilation and pressor support
- 3/ 32 (9%) neurologic deficits
- **Schutze G et al. Pediatr Infect Dis J. 2007:26:475-79**

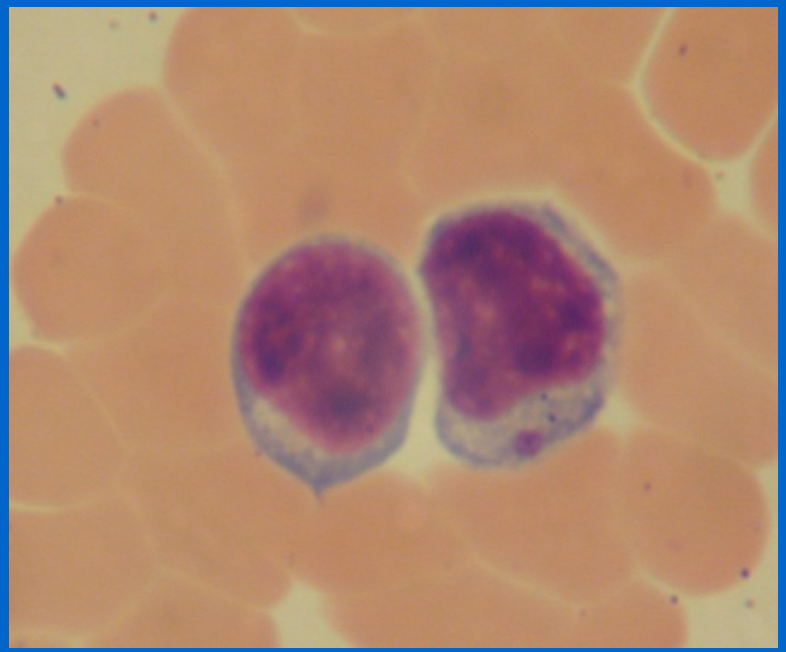
Fever	100%
Headache	69%
Myalgia	69%
Rash	66%
Mental status Δ	50%
Thrombocytopenia	94%
Elevated AST	90%
Elevated ALT	74%
Leukopenia	56%

Ehrlichiosis Rash



- Rash in 60% with *Ehrlichia chaffeensis*
- Rash in 10% with Anaplasmosis
- Rash involves trunk; spares hands and feet
- Develops one week after onset of illness

Ehrlichiosis: Diagnosis

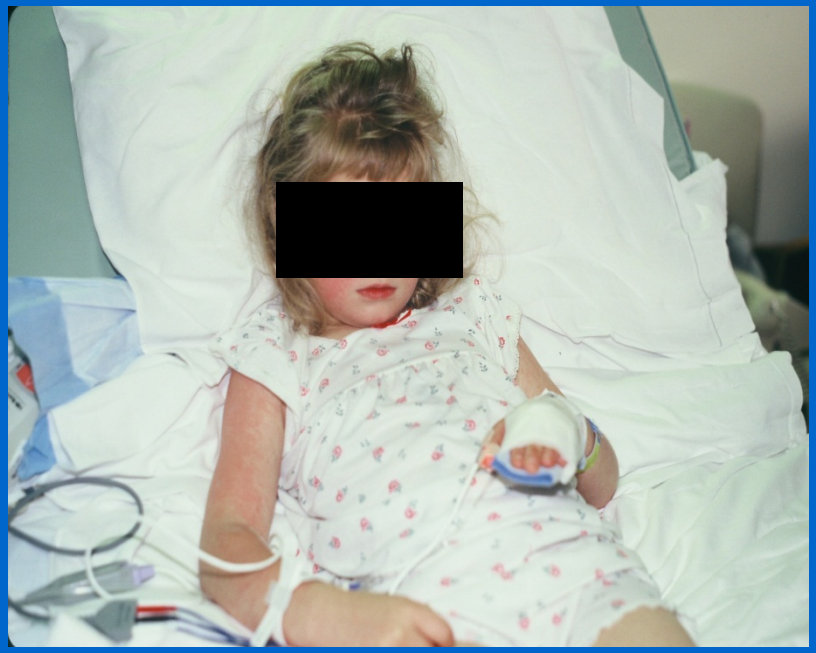


- Fever, headache, myalgia, anemia, leukopenia, thrombocytopenia, elevation liver transaminases
- Serology (four fold rise in titer)
- Ehrlichia or Anaplasma DNA
- Ehrlichia or Anaplasma antigen by immunohistochemical stain
- Ehrlichia or Anaplasma bacteria in cell culture
- Morula in cytoplasm of monocytes or granulocytes

Ehrlichiosis and Anaplasmosis: Treatment

- Begin empiric Doxycycline as soon as possible
- Do not delay therapy awaiting serologic confirmation

Ehrlichiosis Case



- 7 year old girl with 1 week of fever to 40, fatigue poor appetite, generalized aches and pains.
- ER: Rash, conjunctival injection, lethargic.
- Labs: WBC = 1.78 59% neutrophils. HCT = 28%, plts = 67,000. ALT = 83, AST = 181. Sodium = 133.

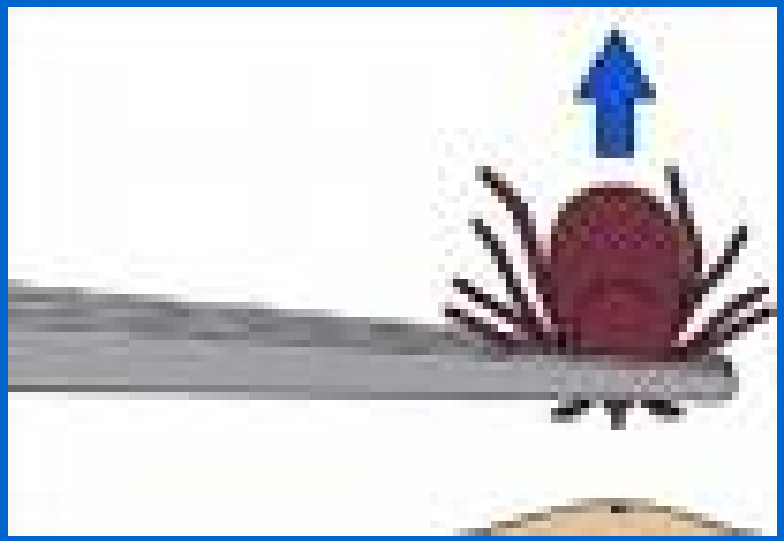
Ehrlichiosis Case (continued)

- Admitted and ceftriaxone and clindamycin begun
- Later on DOA she developed hypotension, responsive to normal saline boluses
- WBC continued to drop and ALT, AST to rise
- Morula noted in monocytes on peripheral smear
- Doxycycline therapy initiated
- Hypotension resolved 24 hours after Doxycycline
- WBC began to recover 48 hours after Doxycycline
- *Ehrlichia chaffeensis* PCR and serology positive

Prevention of Tickborne Diseases

- Check for attached ticks
- Remove entire tick without crushing tick
- Long-sleeved shirts and long pants
- Permethrin sprayed on clothing
- DEET 10-30% (≥ 2 months) on exposed skin
  - Use sparingly
  - Do not apply to hands or face of child
  - Wash off when coming indoors
- **Clin Infect Dis 1998; 27: 1353-1360 and 2012 Redbook p. 208**

Tick Removal



- Use forceps
- Grasp tick firmly by the mouthparts
- Pull directly upwards

Summary: Lyme

- Order serologic tests for Lyme only when clinical evidence suggests Lyme Disease
- Do not order Lyme serology for nonspecific signs such as fatigue or arthralgia (risk false positives)
- Serologic tests should not be used as the sole criterion for diagnosing Lyme Disease
- Testing of ticks for pathogens has poor predictive value and is discouraged
- Maximum duration for therapy course is 4 weeks

Summary: RMSF and Ehrlichiosis

- Always treat empirically with Doxycyline based on clinical suspicion
- Do not postpone treatment waiting for laboratory confirmation
- Counsel re: appropriate tick prevention strategies

- **Handle engorged ticks with care !**

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- Detail how to counsel patients regarding **Prevention of Tickborne Diseases** and **Tick Removal**

Resources

1. Lyme Disease. Committee Infect Dis. AAP. Redbook. 2012. pp. 474-79.

2. Characterization of Lyme Meningitis and Comparison with Viral Meningitis in Children. Eppes S et al. Pediatrics. 1999. 103:957-60.

3. Outcomes of Children Treated for Lyme Arthritis: Results of a Large Pediatric Cohort. Tory HO et al. J Rheumatol. 2010. 37:1049-1055.

4. Rocky Mountain Spotted Fever in Children. Woods CR. Pediatr Clin N Am. 2013. 60:455-70.

5. Human Monocytic Ehrlichiosis in Children. Pediatr Infect Dis J. 2007. 26: 475-79.