What Doctors Need To Know About

Tick Borne Diseases in the Pediatric Patient

April 20, 2013
Ann F Corson MD
Tick Borne Disease (TBD)

- All health care providers, mental health professionals and educators in tick endemic areas need to recognize:
  - Growing prevalence of disease after tick bites
  - Clinical manifestations of TBD - protean
  - Children with both acute and persistent TBD so appropriate medical, psychological and educational assistance may be obtained
  - Children diagnosed with neuropsychiatric, learning or attention disorders may indeed have infectious diseases that are treatable

Tick Bites

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Tick Bites

Endemic Tick Borne Diseases

- Ticks are cesspools of disease
  - *Borrelia burgdorferi*, over 300 strains worldwide
  - Other *Borrelia* species (*lonestari, garinii, afzelii*, others)
  - *Babesia microti, Babesia duncani*, others
  - *Ehrlichia chaffeensis* or Human Monocytic Ehrlichia (HME)
  - *Anaplasma phagocytophilum* or Human Granulocytic Anaplasmosis (HGA)
Endemic Tick Borne Diseases

- Ticks are cesspools of disease, continued
  - *Bartonella henselae* (cat scratch fever), *Bartonella sp.*, *Bartonella*-like organisms
  - *Mycoplasma fermentans* (Gulf War Syndrome)
  - *Rickettsia rickettsia* or Rocky Mountain Spotted Fever (RMSF)
  - *Francisella tularensis*, or Tularemia
  - *Coxiella burnetii*, or Q fever
  - Viruses (HHV-6, deer tick encephalitis)
  - Nematodes and Protomyxzoa?

Identifying Children With Lyme Disease

- Lyme is truly the “Great Imitator” of our times just as syphilis was for prior generations
- Onset of the illness can be abrupt or indolent
- All organ systems of the body can be affected
- Symptoms are often vague and shifting from day to day therefore many children are thought to be malingerers or be emotionally disturbed
- Children often don’t understand what is happening to their bodies and have a hard time explaining often unusual or bizarre symptoms
## Identifying Signs And Symptoms

### How does Lyme disease present?
- Flu-like illness at any time of the year
- Fatigue, often unrelieved by rest
- Unexplained fevers, often cyclical
- Headaches of all kinds
- Frequent infections: viral, bacterial and/or fungal
- Recurrent swollen lymph nodes
- Recurrent sore throats
- Chest pains, shortness of breath, dry cough

### How does Lyme disease present? – cont.
- Abdominal pain of all kinds
- Changes in appetite
- Irritable bowel symptoms with changes in stooling patterns
- Joint pains, migratory and intermittent
- Deep bone pains
- Myalgias, muscle spasms and twitches
- Urinary urgency and frequency, dysuria, incontinence
Identifying
Signs And Symptoms

  - Rashes of all kinds that come and go
  - New onset neurological and/or psychiatric symptoms
  - Sleep disturbances
  - New onset aerobic exercise intolerance
  - Dark circles under the eyes
  - Intermittent red, hot pinnae
  - Increased allergies and chemical sensitivities

Identifying
Signs And Symptoms

- Caveats:
  - Less than 50% of children with Lyme disease remember a tick bite.
  - Even less remember an EM rash.
  - EM rash has highly variable appearance
Lyme Rashes

Photo: Edwin Masters, MD and LDA
In Depth Signs And Symptoms

Neurological symptoms

- 90% of children have a deterioration in school performance due to cognitive dysfunction
  - Difficulty with concentration and attention
  - Easy distractibility, often labeled as ADD
  - Word and name retrieval problems
  - Short term memory difficulties
  - Decreased reading comprehension
  - Impaired speech fluency
  - Dyslexic-like errors
  - Loss of mathematical skills

Neurological symptoms, continued

- Children with TBD disease demonstrate defects in auditory and visual sequential processing
  

In Depth Signs And Symptoms

- Neurological symptoms, continued
  - Encephalopathy, confusional states
  - Headaches of all kinds
  - Sensory hypersensitivity to noise, light, odors, touch
  - Poor balance and coordination
  - Gait abnormalities
  - Loss of previously acquired motor skills
  - Movement disorders: spasticity, ataxia
  - Motor or vocal tics
  - Convergence and visual tracking problems

Motor Tic
In Depth Signs And Symptoms

- Neurological symptoms, continued
  - Spinal cord myelopathies
  - Radiculopathies: Bannwarth’s syndrome
  - Peripheral neuropathies: paresthesias, subtle weakness, mild to severely painful
  - Cranial neuropathies: Bell’s Palsy, optic neuritis, hearing or swallowing difficulties
  - Autonomic dysfunction: Pots syndrome
  - Partial complex seizures, grand mal seizures
  - Pseudo tumor cerebri

Bell’s Palsy

Left: May 2007
Right: May 2009
Bell’s Palsy

In Depth Signs And Symptoms

- Psychiatric Symptoms
  - Uncharacteristic behavior outbursts, mood swings, irritability, emotional lability
  - Social withdrawal, decreased participation in activities
  - Depression
  - Suicidal thoughts in over 40%
  - Rage and anger management disorders
  - Anxiety disorders, panic attacks
  - Depersonalization
Depersonalization

In Depth Signs And Symptoms

- Psychiatric Symptoms, cont.
  - Oppositional behaviors
  - Frustration intolerance
  - Obsessive compulsive disorders
  - Hallucinations of all kinds
  - Psychosis
  - Personality changes
  - Self-mutilating behaviors
Special Age Groups
Signs And Symptoms

- Pre-schoolers and toddlers
  - Mood swings, sudden emotional outbursts
  - Irritability
  - Personality changes
  - Return of separation anxiety
  - New phobias
  - Regression of motor and social skills (loss of developmental milestones)
  - Changes in play behavior, tire easily, less active

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Special Age Groups
Signs And Symptoms

- Pre-schoolers and toddlers, cont.
  - Trouble falling asleep, frequent awakenings, hard to get them to sleep at night
  - Nightmares, night terrors, sleep walking
  - Diaper rash unresponsive to normal treatment
  - Return to bedwetting or loss daytime bladder control after being dry
  - Frequent URIs, ear and throat infections, bronchitis, pneumonia

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Co-Infections

- Co-infections are the rule, not the exception
  - 80% of my pediatric patients co-infected
  - Co-infections often best diagnosed clinically
  - Co-infected patients are:
    - Sicker
    - More likely to have failed prior treatment
    - Require longer treatment with multiple agents
- Co-infections must be eradicated or *Borrelia* infection will persist
Signs and Symptoms of Coinfections

- *Babesia* species:
  - High fever with initial infection, later cyclical fevers
  - Night sweats or chills (come in clusters in 1-2 week cycles)
  - Profound fatigue
  - Headache
  - Myalgias
  - Deep bone pains (especially of the distal extremities)

- *Babesia* species, continued:
  - SOB, dry cough, chest pain
  - Painful soles of feet
  - Poor balance
  - Severe brain fog/encephalitis
  - Anxiety, panic attacks
  - Chronic low grade anemia, elevated ferritin
  - Hypercoagulability
Signs and Symptoms of Coinfections

- **Bartonella henselae:**
  - Fatigue
  - Insomnia
  - Headache
  - Abdominal pain
  - Lymph node enlargement
  - Transient soreness of soles of feet upon standing first thing in the morning

- **Bartonella henselae, continued:**
  - Psychiatric disorders of all kinds
    - Rage attacks, anger
    - Obsessive compulsive behaviors
    - Cutting/self mutilating behavior
  - Neurological symptoms
    - Resistant radiculopathies
    - New onset seizure disorder
    - Acute encephalitis, disorientation, memory loss
    - Ataxia, tremors
Signs and Symptoms of Coinfections

- *Bartonella henselae*, continued:
  - Subcutaneous nodules (shins, thighs)
  - Rashes
    - Acne like eruptions
    - “Stretch marks”

Bartonella Rashes

*Photo by Dr. Martin Fried, with thanks to LDA*
Bartonella Rashes

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Signs and Symptoms of Coinfections

- Ehrlichiosis (HME) and Anaplasmosis (HGA):
  - High fevers
  - Flu like symptoms and myalgias
  - Sharp stabbing shooting headache pains
  - Seizures
  - Psychiatric symptoms
  - Low WBC and platelets, elevated liver enzymes

- Mycoplasma fermentans
  - Fatigue
  - Abdominal pain
  - Myalgias
  - Psychiatric symptoms
Treatment

- Treatment lasts as long as is necessary
  - Until children are completely symptom free for several months
  - No recurrence of Lyme symptoms with concomitant illnesses or stresses
  - Sickest children often need many months of intravenous, intramuscular and oral antibiotic therapy
  - Children whose diagnosis and treatment are delayed may suffer permanent neurological and physical impairment
Caveats

- Any child who becomes ill after a tick bite needs a full evaluation for the presence of co-infections.
- Any child who becomes ill after a tick bite who was treated with 3 to 4 weeks of oral antibiotics has most likely been inadequately treated.
- Initial inadequate treatment makes future treatment more difficult.

Caveats

- Neurological and/or neuropsychiatric signs and symptoms are often the first and only presenting sign of infection.
- Neurological and/or neuropsychiatric signs and symptoms are often the most common indication of persistent infection after inadequate treatment.
Selected References

- *Cure Unknown Inside The Lyme Epidemic*  
  by science writer Pamela Weintraub, senior editor at *Discover* magazine  
  - Available at Amazon.com

- *Under Our Skin*  
  film documentary from Open Eye Pictures directed by Andy Abrahams Wilson  
  - Available at Amazon.com  
  - [www.underourskin.com](http://www.underourskin.com)  
  - Trailers on YouTube
Selected References

Web sites:
- www.ilads.org
  - The International Lyme and Associated Diseases Society’s web site - health care professionals
- www.lymeinfo.net
  - Educational site with hundreds of medical references
- www.lymedisease.org
  - Lyme Disease Association web site

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Selected References


Selected References


Appendix 1 - Testing

Two tiered CDC test: ELISA with confirmatory Western Blot (WB)

- Developed for surveillance *not* diagnosis
- The CDC itself states that it is inappropriate to use surveillance case definitions for
  - establishing clinical diagnoses
  - determining the standard of care necessary for a particular patient
  - setting guidelines for quality assurance
  - providing standards for reimbursement

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Appendix 1 - Testing

Two-tiered CDC test: ELISA with confirmatory WB

- In 1996, New York State Department of Health:
  - found CDC’s two tiered testing missed 82% positive Lyme cases
  DeBuono, B. NY Dept of Health report to CDC April 15, 1996
- In 1997, College of American Pathologists stated:
  - commercially available FDA-approved kits were only 36-70% sensitive
  - ELISA assay did not have adequate sensitivity to be part of a two tiered approach to diagnosis
  Bakken et al., *J Clin Microbiol* 1997; 35(3): 537-543

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Appendix 1 - Testing

Two-tiered CDC test: ELISA with confirmatory WB
- In 2005, John’s Hopkins University study:
  - found CDC two tiered testing missed 75% of positive Lyme cases
  Coulter, et al., J Clin Microbiol 2005; 43: 5080-5084

A CDC positive Western Blot:
- Requires presence of several non-species specific bands that are common to many spirochetes besides Borrelia burgdorferi
- Omits two of the most species specific Bb bands (31, 34)
- A positive Western Blot need only show one species-specific band to demonstrate exposure to Bb therefore confirming a clinical diagnosis of Lyme disease
  - These species-specific bands are: 18, 23-25, 31, 34, 39, 83-93 kDa.
  Harris, NS. J Spirochetal Tickborne Dis 1998; 5(1): 16-26
Appendix 1 - Testing

- Cerebrospinal fluid analysis - mostly normal
  - "B. burgdorferi antigen can be detected in CSF that is otherwise normal by conventional methodology, and can be present without positive CSF antibody. Since CSF antigen implies intrathecal seeding of the infection, the diagnosis of neurologic infection by B. burgdorferi should not be excluded solely on the basis of normal routine CSF or negative CSF antibody analyses."
  

- Slightly elevated protein, slight leukocytosis
- Intrathecal antibodies in less than 9%
- Only perform tap to rule out other diseases
- Normal results DO NOT rule out neuroborreliosis


- One patient with chronic relapsing neuroborreliosis had 13 spinal taps, all PCR or culture positive but only once positive for intrathecal antibody production to Bb antigens.

Coyle, PK et al., *Neurology* 1995; 45: 2010-2014
Appendix 2 - WB Serology

Charles Ray Jones, M.D.
Addendum Regarding Lyme Serology

There are nine known (Lyme) *Borrelia burgdorferi* genus species specific kDa Western blot antibodies (bands): 18, 23-25, 31, 34, 37, 39, 83-93.

Only one of these *Borrelia burgdorferi* genus specific bands in needed to confirm that there is serological evidence of exposure to the *Borrelia burgdorferi* spirochete and can confirm a clinical diagnosis of Lyme disease.

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Appendix 2 - WB Serology

CDC Western Blot IgM surveillance criteria includes only two *B burgdorferi* genus species specific antibodies for IgM 23 and 39 and excludes the other seven *B burgdorferi* antibodies.

CDC Western Blot IgG surveillance criteria includes 18, 23, 30, 37, 39 and 93 and excludes bands 31,34 and 83.

It does not make sense to exclude any *B burgdorferi* genus species specific antibodies in a Lyme Western Blot, and to include only two of these antibodies in IgM because all the antibodies in IgG were once IgM.
Appendix 2 - WB Serology

IgM converts to IgG in about two months unless there is a persisting infection driving a persisting IgM reaction. This is the case with any infection, including a *B burgdorferi* induced Lyme disease.

The CDC wrongfully included five non-specific cross reacting antibodies in its Western Blot surveillance criteria: 28.41.45.58 and 66. This leads to the possibility of false positive Lyme Western Blots. There can be no false positives if only *Borrelia burgdorferi* genus species specific antibodies are considered.

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Appendix 2 - WB Serology

One can have a CDC surveillance positive IgG Lyme WB with the five non-specific antibodies without having any *Borrelia burgdorferi* genus species specific antibodies. This does not make sense.

The CDC recommends that the Lyme Western Bolt be performed only if there is a positive or equivocal Lyme ELISA. In my practice of over 10,000 children with Lyme disease, 30% with a CDC positive Lyme Western Blot have negative ELISA’ s. The Lyme ELISA is a poor screening test. An adequate screening test should have false positives, not false negatives.

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