

**Tick-Borne Illnesses,  
Autism Spectrum Disorders and  
ADHD/ADD: Neuropsychological  
Features in Children**

The Lyme-Autism Connection Conference and Physicians' Training  
LIA Foundation  
June 27, 2008

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**Presentation Overview**

- “ Lyme, ASD, ADHD and ADD
- “ Neuropsychology
- “ Neuropsychological Evaluation
- “ Neuropsychological Findings in Tick Borne Illnesses
- “ Environmental Conditions and Impact on Functioning
- “ Environmental Modifications and Educational Accommodations

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**Lyme/ASD/ADD**

- “ Subset of children diagnosed with ASD have evidence of Bb infections.
- “ Lyme may produce a vulnerability during fetal development and infancy that may lead to “increased vulnerability for developing autism spectrum disorders.” (Bransfield et. al., 2007)
- “ Children with gestational Lyme diagnosed with ASD and ADHD (Jones, et al., 2005)
- “ “Autism is an inflammatory encephalitis caused by a pathogen such as Bartonella or Mycoplasma.” (Burrascano, Bransfield quote, 2008)

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**Lyme/ASD/ADD**

- “ Children diagnosed with Lyme disease who are seen for neuropsychological evaluation often present with prior diagnoses
  - “ ASD/PDD
  - “ ADD/ADHD
  - “ Sensory Integration Disorder
  - “ Auditory Processing Disorder
  - “ Language Disorder
  - “ Oppositional Defiant Disorder

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**Lyme/ASD/ADD**

- “ Subset of children diagnosed with Lyme disease who are seen for neuropsychological evaluation:
  - “ Longstanding histories of health and developmental problems.
  - “ Symptoms from infancy, resolve, recur and increase in severity and frequency
  - “ History of a family member with Lyme or chronic health problems.
  - “ History of erratic school performance and attendance.

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**Lyme/ASD/ADD**

- “ Children diagnosed with Lyme may have ASD symptoms.
- “ Diagnoses may represent Lyme symptoms rather than end diagnoses.
- “ Responsive, attentive and focused during a neuropsychological evaluation.
- “ Interactive and show good eye contact during a neuropsychological evaluation.

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**Lyme/ASD/ADD:**

**Overlapping Symptoms and Behavioral Similarities**

- “ Attention/concentration
- “ Social interaction
- “ Emotional
- “ Disrupted language development
- “ Communication skills
- “ Sensory disturbances and sensitivities
- “ Academic performance

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**Neuropsychology**

- “ The study of brain-behavior relationships.
- “ Explores how brain function is reflected in cognition, perception, emotion and behavior.
- “ Explores the functional impact of neurological disease, illness and injury.

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**Neuropsychology and Tick-Borne Diseases**

- “ The central nervous system is a primary site.
- “ Brain function is frequently compromised.
- “ Cognitive, emotional and behavioral symptoms are common in Lyme disease/TBD.
- “ These symptoms negatively impact academic, vocational, interpersonal and family functioning.

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**Children Evaluated**

- “ 54 children
- “ Ages 6 to 15
- “ Nationwide: NY, CT, NJ, VA, MD, PA, MA, TN, AZ, CA, FL, MN, NV, RI, NH
- “ Positive Lyme test results
- “ History of chronic medical problems
- “ Chronic ear infections (39%)
- “ Lyme in other family members
- “ Erratic school attendance and performance

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**Presenting Problems**

- “ Attention/Concentration 87%
- “ Sensory Integration 21%
- “ Auditory Processing 33%
- “ ADHD/ADD 22%
- “ Sensory Sensitivities 25%
- “ Fatigue 66%

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**Presenting Problems**

- “ Anxiety/Panic Attacks 54%
- “ Mood swings 50%
- “ Depression 37%
- “ Sadness 30%
- “ Rages/Explosive Behavior 25%
- “ Anger/Irritability 53%

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**Neuropsychological Evaluation**

- “ Document innate intellectual level
- “ Delineate a pattern of strengths and weaknesses across skill domains
- “ Identify reduction in ability in specific skill domains
- “ Describe reductions and deficits in relation to brain function
- “ Describe patterns of functioning relative to brain dysfunction

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**Neuropsychological Evaluation: Goals**

- “ Support medical findings and diagnosis
- “ Provide information for further diagnostic testing
- “ Provide information for treatment planning
- “ Provide information for academic planning and accommodations
- “ Provide information for advocacy
- “ Provide family support

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**Neuropsychological Evaluation: Sooner Rather Than Later**

- “ Retrospective review reveals long standing difficulties and declining functioning
- “ Neuropsychological weaknesses may be variable and inconsistent
- “ Changes in functioning may be attributed to other causes
- “ Child putting forth much greater effort to maintain grades and keep up with work

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**Neuropsychological Evaluation: Sooner Rather Than Later**

- “ Self-confidence and self esteem compromised
- “ Loss of interest in previously enjoyed activities
- “ Missed developmental experiences
- “ Mood and behavioral changes
- “ Decline over time

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**Neuropsychological Evaluation: Sooner Rather Than Later**

- “ Abnormal is normal
- “ Sense of loss
- “ Feel “stupid”
- “ Defined by diagnosis
- “ Inappropriate school placement

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**Neuropsychological Domains**

- “ Intellectual Ability
  - “ Auditory/Verbal and Visual Reasoning
  - “ Visual Spatial
  - “ Visual Motor
  - “ Visual Discrimination
- “ Processing speed
- “ Working memory

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**Neuropsychological Domains**

- “ Attention and concentration
- “ Executive Functions
  - “ Organization
  - “ Planning
  - “ Problem Solving
- “ Auditory Processing
- “ Visual processing

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**Neuropsychological Domains**

- “ Memory
- “ Language and Communication
- “ Verbal Fluency and Word Finding
- “ Academic
- “ Emotional
- “ Behavioral
- “ Interpersonal

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**Neuropsychological Test Battery**

- “ Wechsler Intelligence Scale for Children (WISC-IV)
- “ Wechsler Individual Achievement Test (WIAT-II)
- “ Gray Oral Reading Test (GORT-IV)
- “ Nelson-Denny Reading Test
- “ Cognitive Assessment System (CAS)
- “ NEPSY: A Developmental Neuropsychological Assessment

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**Neuropsychological Test Battery**

- “ Wide Range Assessment of Memory and Learning (WRAML2)
- “ Rey Complex Figure Test
- “ Sentence Completion Test
- “ Behavior Rating Inventory of Executive Function (BRIEF)
- “ Purdue Peg Board
- “ Clinical Evaluation of Language Fundamentals (CELF-3)

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**Neuropsychological Patterns: Strengths**

- “ Intellectual:
  - “ Verbal abstract reasoning
  - “ Word knowledge
  - “ Common sense reasoning and social judgment
  - “ Recall of facts
  - “ Word Reasoning
  - “ Visual abstract reasoning
- “ Academic:
  - “ Oral Expression

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**Neuropsychological Patterns: Weaknesses**

- “ Intellectual:
  - “ Working memory
  - “ Processing speed
  - “ Discrimination of visual detail
- “ Academic:
  - “ Word decoding
  - “ Phonetic decoding
  - “ Spelling
  - “ Reading rate

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**Neuropsychological Patterns:  
Weaknesses**

- “ Memory:
  - “ Visual and verbal memory
  - “ Visual and verbal recognition memory
- “ Attention and Executive Function:
  - “ Visual scanning
  - “ Divided attention
  - “ Verbal fluency
- “ Fine motor coordination
- “ Graphomotor speed

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**Recommendations**

- “ Audiological evaluation
- “ Speech and Language evaluation
- “ Neuro-optometric evaluation
- “ Physical Therapy evaluation
- “ Occupational Therapy evaluation
- “ Assistive Technology Evaluation
- “ Individual Cognitive Remediation
- “ Individual Psychotherapy
- “ Supportive Family Therapy
- “ Mind-body Techniques
- “ Nutritionist Consultation
- “ Classification and Academic Accommodations (environmental and instructional)

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**Environmental Conditions**

- “ Bright lights
- “ Ambient noise
- “ Competing stimuli
- “ Multiple tasks
- “ Time constraints
- “ Complex visual arrays
- “ Unstructured and confusing visual arrays
- “ Textures and tastes

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**Environmental Conditions**

- “ Noisy environments
- “ Crowds
- “ Restaurants
- “ Parties
- “ Situations requiring quick decisions

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**Academic Accommodations**

- “ Shortened school day
- “ Excusal from school attendance policy
- “ Modified course requirements
- “ Small classes and opportunities for one-to-one instruction
- “ Preferential classroom seating
- “ Access to school nurse
- “ Buddy for class change

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**Academic Accommodations**

- “ Hands-on learning experiences.
- “ Use of a computer for learning opportunities.
- “ Printed information to supplement classroom chalkboard information.
- “ Printed outline to supplement class lesson
- “ Printed homework assignments.
- “ Classroom aide
- “ Scribe

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### Academic Accommodations

- “ Provide questions to be answered for reading assignments.
- “ Reduce length of reading assignments.
- “ Chunk information for assignments and tests.
- “ Regular meetings with teachers
- “ Use of visual materials that are discrete and simplified.

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### Academic Accommodations

- “ Extended time for assignments and tests.
- “ Multiple choice learning and testing format.
- “ Oral presentations.
- “ Discussion of subject matter.
- “ Allow student the opportunity to raise his/her hand in class.
- “ Open book tests.

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### All Purpose Strategies

- “ Problem solving and strategy notebook
- “ Language to talk about illness
- “ To-do and check lists
- “ Repetition of information
- “ Dictate writing assignments
- “ Pacing

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### All Purpose Strategies

- “ Reduce distractions
- “ Verbal mediation
- “ Develop a language to talk about illness
- “ Time lines
- “ Minimize need to quickly generate information

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### “Out of the Mouth of Babes”

- “ “My brain shuts down.”
- “ “I do this in school and it’s easier. It blocks out the sound because my shoulder is there.”
- “ “I don’t care. I give up.”
- “ “Sometimes I feel like I don’t fit in at home or at school.”
- “ “What’s the use of studying when I don’t remember it the next day for the test.”
- “ “I tell myself that it won’t last forever.”

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