

Psychiatric Aspects of Lyme Disease in Children and Adolescents: A Community Epidemiologic Study in Westchester, New York

Brian A. Fallon, M.D., M.P.H.,* Hector Bird, M.D., Christina Hoven, Dr. P.H., Daniel Cameron, M.D., M.P.H., Michael R. Liebowitz, M.D., and David Shaffer, M.D.

Department of Psychiatry, College of Physicians and Surgeons of Columbia University and Division of Therapeutics, NYS Psychiatric Institute, New York, New York (B.A.F., M.R.L.); Division of Child Psychiatry, College of Physicians and Surgeons of Columbia University and Department of Child and Adolescent Psychiatry, NYS Psychiatric Institute, New York, New York (H.B., C.H., D.S.); and Private Practice, Mount Kisco, New York (D.C.)

To date, no community study has examined the psychiatric aspects and or sequelae of Lyme disease (LD) among children. As part of a community epidemiologic study of psychiatric disorders among children ages 9 through 17 in a Lyme endemic county, parents were asked whether their child had ever been diagnosed as having LD, and 10.1% (36/357) responded yes to the LD question. Of the 36, 29 also agreed to take part in a follow-up interview. Sixteen of the 29 children had had physician-diagnosed LD as well as either an erythema migrans rash or a positive serology. Fifteen of these 16 received treatment within 1 month of symptom onset; none of these 15 children were symptomatic longer than 4 months. Only one child had physical symptoms at the time of the interview; she was not treated until 4 months after symptom onset. This child experienced 5 years of intermittent arthritis, cognitive deficits, emotional problems, severe fatigue, and a deterioration in school performance. Courses of oral antibiotics were at first associated with a good response, followed by a resurgence of symptoms months later. The lifetime prevalence of LD by history among children ages 9 through 17 in an endemic area may be at least 44.8/1000. In general, when LD is diagnosed early, it responds well to treatment. Delayed diagnosis and treatment may lead to a chronic course.

INTRODUCTION

Lyme disease, a multisystem illness caused by the spirochete *Borrelia (B.) burgdorferi*, can cause neuropsychiatric problems (1). In adults with neurologic Lyme disease, common psychiatric problems include memory loss, word finding problems, depression, mood lability, and irritability. Paranoia, mania, schizophrenia-like states, and anxiety disorders may also occur (2).

Less is known about the neuropsychiatric profile of Lyme disease in children. Published case reports have associated Lyme disease with anorexia nervosa (3) and, in older teenagers, with obsessive compulsive disorder (2, 4), panic disorder (2), personality changes with aphasia and apraxia (5), and a catatonic-schizophrenic-like syndrome (6). In the latter case, *B. burgdorferi* was isolated from the cerebrospinal fluid (CSF) of a 19-year-old boy with no prior psychiatric history; the psychotic disorder resolved with antibiotic treatment.

Two studies have looked at children with late-stage Lyme disease. In one study of 46 children with Lyme arthritis, 10 children (22%) had had aseptic meningitis or facial palsy (7). In another study (8) of 96 seropositive children ages 3 through 19, who presented with new neurologic symptoms, the two most frequent features were headaches (71%) and behavioral or mood changes (38%). Listlessness, irritability, malaise, and decreased interest in play were common among preschoolers, while emotional lability was more common among school-age children.

Current studies are limited by sampling bias and the absence of standardized measures of psychiatric morbidity. In addition, because the published studies focused on late-stage

Lyme disease, it is not known whether early Lyme disease is also associated with significant psychiatric problems.

In this study, two questions were addressed. First, by history, what is the lifetime prevalence of Lyme disease among children ages 9 through 17 in a Lyme endemic area? Second, what is the frequency of psychiatric disorders among children with carefully defined Lyme disease?

METHODS

In 1992, as part of a National Institute of Mental Health (NIHM) Collaborative study, probability samples of children ages 9 through 17 years and their parents (usually the mother) were interviewed at one of four sites across the United States. The purpose of the study (MECA Study) (Lahey et al., unpublished manuscript) was to assess methods for use in psychiatric epidemiologic surveys of child and adolescent populations and the feasibility of carrying out such studies in the community for a national study. The data used in the present report were gathered from the New York State Psychiatric Institute/Columbia University Site ($n = 357$). Randomly selected children and their parents were drawn from households in 15 randomly selected communities in Westchester County, New York. The sample is representative of the population of Westchester County. The 2 hour interview consisted of a standardized psychiatric diagnostic assessment (the NIMH-Diagnostic Interview Schedule for Children (DISC), Version 2.3) (9) and a schedule that collected demographic data as well as data on medical and mental health service utilization and risk factors for childhood psychopathology. In general, the DISC asks about the behavior and mood of the child during the 6 month period prior to the interview. All interviews were conducted by trained lay interviewers.

As part of the health history, the following two questions

*Corresponding author

were asked of the parent: "Has your child ever been diagnosed as having Lyme disease?" and "Would you be willing to be contacted by a researcher interested in interviewing children who have had Lyme disease and those who have not had Lyme disease?" Affirmative answers to both questions led to a telephone follow-up interview to explore further the diagnosis of Lyme disease.

RESULTS

In this study, 357 households participated. The racial composition of the children in this sample was mixed: 74.6% white, 17.5% black, and 7.9% other; 52% of the children were male, and 48% were female. These percentages proportionately reflect the racial and gender distribution of Westchester County.

Thirty-six of the 357 children's parents (10.1%) reported that the child had been diagnosed as having had Lyme disease. In the Northern Westchester communities, 27 of the 130 parents (20.8%) reported a past history of Lyme disease in the child. Of the 36 children in the total sample with a history of Lyme disease, the mean age was 13.2 (range 9 to 17). Half were female and half were male.

Of the 36 households in which the child had had the diagnosis of presumed Lyme disease, 29 (81%) of the parents allowed us to conduct a follow-up telephone interview. We used the following criteria for Lyme disease to confirm the diagnosis: (a) history of exposure to a Lyme endemic area; (b) physician-diagnosed Lyme disease; and either (c) a physician-diagnosed erythema migrans rash or (d) serologic evidence of Lyme disease with at least one sign/symptom of systemic illness. All of the children in our sample met the first of these criteria because they resided in Westchester County. Using the remaining criteria (b through d), 16 of the 29 follow-up interviews led to a confirmed diagnosis of Lyme disease. Of the 13 patients who were not included in our confirmed cases, seven had never had Lyme disease (e.g., treated for tick bite but never symptomatic) and five had had signs and symptoms suggestive of Lyme disease but they had not had an erythema migrans rash or positive serologic tests.

Of the 16 children with a history of confirmed Lyme disease, the median duration of illness was 24 days (range: 3 days to 5 years). Fifteen out of 16 youths had been treated within 1 month of symptom onset. Three received IV antibiotics. These three children missed between 2 and 6 weeks of school. Only one child was symptomatic at the time of the follow-up interview. This child began treatment 4 months after symptom onset. Although none of the other children had illness that extended beyond 4 months, this child's course was chronic. She experienced 5 years of intermittent arthritis with swollen knees, memory loss, severe fatigue, paresthesias, headaches, mood swings, depression, irritability, poor concentration, and poor school performance. She had received several courses of antibiotics over the 5 year period (a total of 11 months of oral and 1 month of IV), with an initial good response during each course followed months later by a resurgence of symptoms. On the DISC, she received a current diagnosis of major depression.

Of the 16 children who had had confirmed Lyme disease, five were diagnosed as having a current psychiatric disorder on the DISC. The diagnoses include oppositional defiant disorder (two children), agoraphobia (two children), social phobia (two children), attention deficit hyperactivity disorder (one child), TIC disorder (one child), and major depression (one child).

DISCUSSION

Several findings emerge from this study. First, Lyme disease is a frequently diagnosed condition among children in Westchester County. In this study, 1 in 10 of the parents from Westchester County reported that their child had been diagnosed with Lyme disease at some point. Second, in this study, all but one of the 16 confirmed Lyme cases had received antibiotic treatment within 1 month of symptom onset. Clearly, in this endemic area, parents seem alert to the symptoms of Lyme disease and rapidly seek treatment for their children. Third, this study suggests that in most cases, if treated early, Lyme disease in children is a benign illness with no long-term sequelae.

Using restrictive criteria for the diagnosis of Lyme disease to evaluate putative cases, this study suggests that the frequency of a history of Lyme disease among children ages 9 through 17 in Westchester County may be at least 44.8/1000. These criteria are restrictive in that confirmation of the diagnosis required either a physician-diagnosed erythema migrans rash or positive serologic tests and at least one systemic symptom. It is well known that the rash is only recalled in about two-thirds of the cases and that currently available serologic tests are not always reliable (10). For epidemiologic purposes, such restrictiveness is useful in order to ensure diagnostic conformity but limited in that the prevalence of Lyme disease will be underestimated.

The one persistently symptomatic child, diagnosed at age 12 with Lyme disease, had not been treated until 4 months after symptom onset. A chronic illness may have been prevented had she been treated earlier, as was the case with all of the other children in this study. Her fluctuating symptom profile was associated with severe pain, concentration problems, a deterioration in academic performance, irritability, and major depression. As reported among children with neurologic Lyme disease (8), behavioral and mood disturbances can be part of the Lyme disease profile. Psychiatric disturbances may be a secondary reaction to having a serious illness or a primary reaction induced directly or indirectly by the infection itself. *Borrelia burgdorferi* may initiate an immune reaction directed specifically against neural tissue (11) or it may trigger nonspecific inflammatory responses that cause neuropsychiatric symptoms (12). The immune response may remain active because *B. burgdorferi* antigens are still present or because an autoimmune process has been triggered against host tissue. Because of the combination of articular and psychiatric symptoms and the good response to antibiotics (although temporary), it is likely that this girl's symptoms were due to persistent infection.

The limitations of this study need to be recognized. First, the diagnosis of Lyme disease was made based on information supplied by the parent. Biased or incorrect recall about symptoms or serologic tests may have influenced the results of this study. However, it should be noted that information about the one persistently symptomatic child was confirmed by discussion with the child's treating physician. Second, because our research found that in the majority of cases Lyme disease was recognized and treated promptly, our study conclusions must be limited to children with early Lyme disease; i.e., the favorable results of early administered treatment in our study should not be generalized to children with later-stage illness. The troubling course of the one persistently symptomatic child suggests that more research needs to be conducted on the diagnosis, treatment, and pathophysiology of late-stage Lyme disease. Third, because only one of the 16 confirmed cases displayed phys-

ical symptoms of Lyme disease during the 6 month period covered by the DISC interview, no conclusions can be drawn about the frequency of psychiatric disorders among children with currently active Lyme disease.

In conclusion, childhood Lyme disease when treated early appears to be associated with good outcome. When treatment is delayed, a chronic, relapsing illness may emerge associated with disabling physical, cognitive, and emotional sequelae.

This work was supported by the New York State Psychiatric Institute/Columbia University Site of the MECA Program through Grant U01-MH46718 from the National Institute of Mental Health.

Reprint requests: Brian A. Fallon, M.D., The New York State Psychiatric Institute, 722 West 168th Street, New York, New York 10032.

REFERENCES

1. Logigian EL, Kaplan RF, Steere AC. Chronic neurologic manifestations of Lyme disease. *N. Engl. J. Med.* 323:1438-1444, 1990.
2. Fallon BA, Nields JA. Lyme Disease: A neuropsychiatric illness. *Am. J. Psychiatry* 151:1571-1583, 1994.
3. Pachner AR, Duray P, Steere AC. Central nervous system manifestations of Lyme disease. *Arch. Neurol.* 46:790-795, 1989.
4. Fallon BA, Schwartzberg M, Bransfield R, Zimmerman B, Scotti A, Weber CA, Liebowitz MR. Late stage neuropsychiatric Lyme disease: Differential diagnosis and treatment. *Psychosomatics* (in press).
5. Broderick JP, Sandok BA, Merta LE. Focal encephalitis in a young woman 6 years after the onset of Lyme disease: Tertiary Lyme disease? *Mayo Clin. Proc.* 62:313-316, 1987.
6. Pfister HW, Preac-Mursic V, Wilske B, Rieder G, Forderreuther S, Schmidt S, Kapfhammer HP. Catatonic syndrome in acute severe encephalitis due to *Borrelia burgdorferi* infection. *Neurology* 43:433-435, 1993.
7. Szer IS, Taylor E, Steere AC. The long term course of Lyme arthritis in children. *N. Engl. J. Med.* 325:159, 1991.
8. Belman AL, Iyer M, Coyle PK, Dattwyler R. Neurologic manifestations in children with North American Lyme disease. *Neurology* 43:2609-2614, 1993.
9. Jensen P, Rober M, Fisher P. et al. Test-retest reliability of the Diagnostic Interview Schedule for Children (DISC 2.1): Parent, child and combined algorithms. *Arch. Gen. Psychiatry* (in press).
10. Bakken LL, Case KL, Callister SM, Bourdeau NJ, Schell RF. Performance of 45 laboratories participating in a proficiency testing program from Lyme disease serology. *JAMA* 268:891-895, 1992.
11. Sigal LH, Tatum AH. Lyme disease patients' serum contains IgM antibodies to *Borrelia burgdorferi* that cross react with neuronal antigens. *Neurology* 38:1439-1442, 1988.
12. Halperin JJ, Heyes MP. Neuroactive kynurenines in Lyme borreliosis. *Neurology* 42:43-50, 1992.

The first of these is the concept of the "American Dream," which is the idea that anyone who works hard in America can achieve a better life for themselves and their families.

The second is the concept of "Manifest Destiny," which is the belief that the United States was destined to expand across the continent from the Atlantic to the Pacific.

The third is the concept of "Federalism," which is the system of government in which power is divided between the national government and the state governments.

The fourth is the concept of "Capitalism," which is the economic system in which the means of production are owned by private individuals and operated for profit.

The fifth is the concept of "Democracy," which is the system of government in which the people have the right to elect their representatives to the government.

The sixth is the concept of "Individualism," which is the belief that the individual is the most important unit of society and should be free to pursue their own interests.

The seventh is the concept of "Progressivism," which is the belief that society should be improved through government action and that progress is the goal of human endeavor.

The eighth is the concept of "Isolationism," which is the policy of avoiding involvement in international affairs and focusing on domestic issues.

The ninth is the concept of "Imperialism," which is the policy of extending a country's power and influence through the acquisition of territories and other means.

The first of these is the concept of the "American Dream," which is the idea that anyone who works hard in America can achieve a better life for themselves and their families.

The second is the concept of "Manifest Destiny," which is the belief that the United States was destined to expand across the continent from the Atlantic to the Pacific.

The third is the concept of "Federalism," which is the system of government in which power is divided between the national government and the state governments.

The fourth is the concept of "Capitalism," which is the economic system in which the means of production are owned by private individuals and operated for profit.

The fifth is the concept of "Democracy," which is the system of government in which the people have the right to elect their representatives to the government.

The sixth is the concept of "Individualism," which is the belief that the individual is the most important unit of society and should be free to pursue their own interests.

The seventh is the concept of "Progressivism," which is the belief that society should be improved through government action and that progress is the goal of human endeavor.

The eighth is the concept of "Isolationism," which is the policy of avoiding involvement in international affairs and focusing on domestic issues.

The ninth is the concept of "Imperialism," which is the policy of extending a country's power and influence through the acquisition of territories and other means.

UNIT 2: THE AMERICAN WEST

The first of these is the concept of the "American Dream," which is the idea that anyone who works hard in America can achieve a better life for themselves and their families.

The second is the concept of "Manifest Destiny," which is the belief that the United States was destined to expand across the continent from the Atlantic to the Pacific.

The third is the concept of "Federalism," which is the system of government in which power is divided between the national government and the state governments.

The fourth is the concept of "Capitalism," which is the economic system in which the means of production are owned by private individuals and operated for profit.

The fifth is the concept of "Democracy," which is the system of government in which the people have the right to elect their representatives to the government.

The sixth is the concept of "Individualism," which is the belief that the individual is the most important unit of society and should be free to pursue their own interests.

The seventh is the concept of "Progressivism," which is the belief that society should be improved through government action and that progress is the goal of human endeavor.

The eighth is the concept of "Isolationism," which is the policy of avoiding involvement in international affairs and focusing on domestic issues.

The ninth is the concept of "Imperialism," which is the policy of extending a country's power and influence through the acquisition of territories and other means.

The tenth is the concept of "Frontierism," which is the belief that the frontier is the source of American identity and that the frontier should be expanded.

The eleventh is the concept of "Cowboyism," which is the belief that the cowboy is the symbol of the American West and that the cowboy should be celebrated.

The twelfth is the concept of "Ranching," which is the practice of raising cattle and horses on a large tract of land in the American West.

The thirteenth is the concept of "Mining," which is the process of extracting minerals from the earth, particularly in the American West.

The fourteenth is the concept of "Hunting," which is the practice of killing animals for food or sport, particularly in the American West.

The fifteenth is the concept of "Fishing," which is the practice of catching fish for food or sport, particularly in the American West.

The sixteenth is the concept of "Gardening," which is the practice of growing plants and flowers, particularly in the American West.

The seventeenth is the concept of "Hunting," which is the practice of killing animals for food or sport, particularly in the American West.