

Neuroborreliosis and the pediatric population: a review

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NEUROBORRELIOSIS AND THE PEDIATRIC POPULATION: A REVIEW

Summary. Aims. To review the medical literature on neuroborreliosis, in particular its clinical features in both adults and children, and highlight the differences between the two groups, with an emphasis on the pediatric population. Development. The neurologic manifestations of the disease variably affect different areas of the neuroaxis, central or peripheral, and can present with early or late symptomatology, depending on the age group. Although the literature includes a wide range of neurologic abnormalities, the most frequent symptom reported in the pediatric population is headache, and the most common sign being facial palsy. An immunologic process with cross-reacting antibodies and antibodies directed against neuronal proteins may exist as the causative factor. Because of characteristic cerebrospinal fluid (CSF) findings, CSF examination and serologic testing for *Borrelia burgdorferi*, the causative agent, should be performed in patients, particularly if a child, having been in an endemic area, presenting with an acute neurologic disorder of unexplained etiology. Treatment with antibiotics, if initiated early-on, is curative, especially in children. Conclusions. The pediatric population carries the highest risk for Lyme disease relative to other age groups. Younger patients tend to be more acutely affected, with involvement primarily of the central nervous system, exhibiting an inflammatory response in the CSF and signs/symptoms of aseptic meningitis and facial nerve palsy, whereas older patients present with features of peripheral nervous system pathology, typically with a radiculopathy. Despite having a greater incidence of neuroborreliosis, the clinical course in most children is milder and shorter than that reported for adults. [REV NEUROL 2006; 42 (Supl 3): S91-6]

Key words. *Borrelia burgdorferi*. Children. Lyme disease. Neuroborreliosis. Neurologic. Pediatric.

INTRODUCTION

Lyme disease, first described in 1977 by Steere et al [1] and so named because of an outbreak of arthritis that occurred in Lyme, Connecticut, is a multi-system inflammatory disease, variably affecting skin, joints, heart, eye, and nervous system, caused by the spirochete *Borrelia burgdorferi* which uses the *Ixodes* tick as its vector [2,3]. Infection requires prolonged (> 24-48 h) attachment of the tick with transmission occurring horizontally, either by regurgitation of intestinal contents during feeding or in the case of generalized infection of the ticks, by injection of the tick's saliva as it feeds, typically in the summer and autumn. The geographic distribution of Lyme borreliosis, as it is often referred to, is identical with the habitat of the tick, whose bite spreads the disease. In the Northeastern and Midwestern United States the culprit is *I. scapularis*, while along the Pacific coast, it is the *I. pacificus* [4]. Meanwhile in Europe, the main vector is *I. ricinus* [5]. Diagnosis is made clinically, supported by appropriate laboratory testing [6].

The clinical manifestations can generally be divided into three phases: early localized, early disseminated, and late disease. The neurologic manifestations of Lyme disease, which can occur in the early disseminated or late stages of the disease, were first described in France by Garin et al in 1922 [7] and subsequently by Bannwarth in 1941 [8], who linked it to the preceding erythema migrans (EM), the pathognomonic rash of Lyme disease. Estimates of patients with Lyme disease developing neuroborreliosis, range from 10 to 40% [9,10]. Meningitis,

cranial neuropathy, and radiculopathy are the primary early neurologic manifestations of Lyme disease. Whereas, neurocognitive dysfunction, including encephalopathy with disturbances of mood, memory, and sleep, as well as a myelitis, and a peripheral neuropathy characterize the late form.

The daily activities and playtime routines of children make them more susceptible than adults to tick bites, and thus more likely to be infected by *B. burgdorferi*, and consequently develop the clinical symptoms of Lyme disease, particularly the neurologic features, neuroborreliosis [11-13]. The neurological complications of borreliosis are more common in children [14,15]. Although there is a wide range of neurologic abnormalities affecting children (e.g., focal CNS deficits, ataxia, chorea, myelitis, vertigo, seizures, progressive encephalomyelitis, headaches, and cranial and peripheral neuropathy), acute peripheral facial palsy and aseptic meningitis are the most frequent neurological manifestations of Lyme borreliosis in the pediatric population [13, 16-18]. Conversely, in adults, the Bannwarth's syndrome, a lymphocytic meningitis with cranial palsy (often facial) and radiculoneuritis, rarely observed in children, is the predominant clinical feature of neuroborreliosis [9,19]. There is hence epidemiologic evidence to support that clinically, children show a different disease course from adults [15].

EARLY DISSEMINATED LYME DISEASE

An average of 10 to 15% of untreated patients with Lyme disease in the first weeks and months of their illness will develop the neurologic features of early disseminated disease, with symptoms occurring two to three months after the onset of infection, as dated from the onset of the EM lesion [9,20-22]. Occasionally, these early neurologic symptoms may be delayed for as long as nine months. Early in the course of the illness, some patients are not treated because of being asymptomatic with a subclinical course, namely, since they may never have developed EM, which occurs in 90% of children [13] but as low as 50% of adults [20], the EM lesion was not recognized since it typically

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is neither painful nor purulent, or the patient did not recall experiencing a tick bite. Neuroborreliosis in the early, disseminated form of the disease, may be the first manifestations, may follow or accompany EM, or may occur concurrently with Lyme carditis. The classic triad of the early neurologic impairment of Lyme disease includes meningitis, cranial neuropathy, and radiculoneuropathy, occurring solely or in combination.

Meningitis

Neurologic presentation with an aseptic meningitis is common in children [13-15,18]. Adult and pediatric patients alike presenting with the meningitis associated with Lyme disease typically have a headache that is persistent and may worsen with time. There may be mild to moderate neck stiffness, without associated nuchal rigidity or Kernig/Brudzinski signs, and photophobia, which may continue for several weeks [9]. Fever may be absent or mild, although more commonly seen in European children [15]. Marked fatigue and malaise, however, are common. Meningoencephalitis may be a prominent feature, with impaired memory and ability to concentrate, as well as emotional lability [9,21]. Symptoms will typically occur in the fall months and are self-limited. A lymphocytic pleocytosis is typically found in the cerebrospinal fluid. Because Lyme meningitis is indistinguishable on clinical grounds from an aseptic meningitis, crucial to the diagnosis of Lyme disease is the finding of other associated features of the disease.

Cranial neuropathy

Any cranial nerve may be affected in neuroborreliosis, however, facial neuropathy is the most common [9,21,23]. Bilateral involvement, so as to produce a facial diplegia, can also occur [24]. The facial palsies are often self-limited, usually lasting less than two months, although there have been cases of longstanding, even permanent damage [24]. Neuroborreliosis-associated facial nerve palsy may occur days or weeks after EM, or it may occur with or follow other manifestations of disseminated infections. However, it is often the initial sign of Lyme disease. In certain geographic areas where the disease is endemic, epidemiological studies reveal that Lyme disease-associated facial nerve palsy is approximately 5 to 10 times more common than is idiopathic Bell's palsy. It is, for example, estimated that 10 to 25% of facial nerve palsies in New York, according to a recent study [25] that develop during the summer months are due to *B. burgdorferi* infection.

The facial neuropathy may occur in association with meningitis or other cranial neuropathies. In about 15-20% of patients with cranial neuropathies, multiple cranial nerves may be involved [23]. Patients with Lyme disease and seventh nerve palsy may be differentiated from patients with Bell's palsy (idiopathic facial nerve palsy/paralysis), by the presence of other clinical features of the disease. Clinically, the facial palsy of neuroborreliosis may or may not involve taste and hyperacusis, suggesting that involvement may be either within or external to the subarachnoid space [26]. Painless, non-tender swelling and erythema of the face preceding the facial palsy are distinctive features that may be present and help confirm the clinical diagnosis [27]. The frequency of Lyme-related facial nerve palsy depends on the incidence of Lyme disease in an individual community. Keane [28] in his review of 43 cases of bilateral facial palsy in a nonendemic area found no patients with Lyme disease. However, studies in highly endemic areas indicate that Lyme may account for up to 25% of cases of facial nerve palsy [23].

Some investigators have speculated that, since facial palsies are relatively uncommon in children, Lyme disease is a major cause of facial nerve damage in this population [29,30]. Christen et al [30] in a prospective hospital-based multicenter study in the Northeast of Germany, found Lyme disease to be the most frequently identified cause of facial palsy in children, accounting for nearly 60% of their cases, confirmed with specific IgM antibodies in the CSF. Furthermore, bilateral facial palsy occurred only in children with Lyme borreliosis. It has, hence, been suggested that there may exist age-specific differences in the mode of infection. Due to the shorter stature and the behavioral patterns of children it should be expected that the head-neck region is relatively more affected by tick-bites in children than in adults.

All children in Christen et al's study [30] with neuroborreliosis related facial palsy had CSF abnormalities, with signs of an inflammatory response, consisting of lymphocytic pleocytosis and normal or elevated protein content. These findings were irrespective of whether clinical signs of meningitis were present or not. In only 40% of the idiopathic cases of facial palsy were there CSF changes. In another study of 40 children with Lyme disease-associated facial nerve palsy, Belman et al [25] found CSF abnormalities in 68% of the children. Furthermore, in more than two thirds of these patients, there were no other signs of CSF infection, such as headache or meningeal signs. CSF analysis in isolated Lyme disease facial palsy is usually normal in adults [9,11,24].

With exception of the olfactory nerve, reports describe patients with involvement of all cranial nerves. In a large series of patients with neuroborreliosis from Germany, Sweden, and the United States, close to 40% had cranial neuropathies [31]. About 80% of these involved the VIIth nerve; the remainder were evenly divided among the IIIrd, Vth, VIth, and VIIIth. Cases with a positive history of tick bite and/or EM in the head and neck region manifest ipsilateral neurological symptoms suggesting a direct invasion via the affected nerve by *B. burgdorferi* [30,32].

Radiculoneuropathy

Lyme disease can cause a painful radiculitis clinically manifested by neuropathic symptoms of paresthesias, such as numbness, tingling, and burning, in a dermatomal distribution, with or without accompanying motor or reflex changes, with symptoms mimicking mechanical radiculopathies [26,33]. This radiculoneuropathy may involve the trunk or limbs, upper extremities greater than lower, with symptoms involving the limb that was the site of the tick bite, oftentimes resembling a diabetic truncal neuropathy [26]. Patients may also have concomitant cranial nerve palsies in 50% of cases. The peripheral nerve damage that results is usually an axonopathy, rather than a demyelinating process [34]. Conventional electromyography with nerve conduction velocity studies may be normal if purely sensory nerves are involved. Neurophysiologic testing, however, can demonstrate multifocal nerve damage at other, anatomically remote sites [34]. Somatosensory evoked potential studies, however, yield objective diagnostic information. Patients with pure radiculoneuropathy, in the absence of any other manifestation, often have a normal CSF results. However, even in the presence of CSF changes, meningitic or encephalitic features are infrequent. Since the symptoms are oftentimes self-limited, and the presentation is often indistinguishable from a mechanical radiculopathy, many patients are presumed to have problems

that are mechanical, and are not tested nor treated for Lyme disease. Interestingly, in European patients, radicular symptoms occur about twice as often as cranial neuropathies, whereas in the US this ratio is reversed [31]. It has been speculated that this clinical difference is due to biologic differences between the different *Borrelia* strains that cause the disease [26].

LATE LYME DISEASE

Neurocognitive dysfunction can occur as a late manifestation of Lyme disease. The diagnosis is difficult to establish since Lyme disease is oftentimes underdiagnosed, the symptoms are non-specific, psychologic factors may complicate the presentation, and establishment of the causal relationship may be difficult. Hence, unless Lyme disease is considered as an etiology, the link between the cognitive impairment and the disease may not be made, resulting in lack of a proper evaluation, diagnosis, and treatment. The *B. burgdorferi*-related brain dysfunction may manifest as neurocognitive changes, with or without an encephalopathy. In this tertiary neuroborreliosis, patients may have mild, vague symptoms, characterized by impaired concentration, memory failure, and word finding difficulties [35,36], which may occur in the presence or absence of objective CNS involvement, ie. evidence of CSF immunoreactivity. The CSF will usually not contain oligoclonal bands, the IgG index is normal, and there is mild pleocytosis or a normal cell count and a normal or moderate increase in protein content. However, intrathecal synthesis of antibodies to *B. burgdorferi* can often be demonstrated. It is in this stage of the disease that parenchymal CNS involvement may be noted, namely on magnetic resonance imaging, with focal white matter lesions [37]. Lyme disease-related encephalopathy may be characterized by disturbances of mood, memory, and sleep [38]. In one study, symptoms began 1 month to 14 years after the initial episode of Lyme disease, and may have been present for 3 months to 14 years, which despite the long duration of symptoms, improved after antibiotic therapy [38]. Although these symptoms are certainly not specific to CNS Lyme disease, it is imperative to consider it in the differential diagnosis since it tends to exhibit a progressively deteriorating course, which can be easily and effectively treated. Interestingly, the cognitive dysfunction as part of an encephalopathy secondary to Lyme disease described in the US is not seen in Europe [15].

OTHER NEUROLOGIC MANIFESTATIONS (EARLY OR LATE)

Entrapment neuropathies occur with some frequency, particularly of the median nerve, with symptoms of a carpal tunnel syndrome [39]. This may, in some cases both in child and adult, represent comorbid synovial thickening in the wrist secondary to a Lyme associated arthritis. More diffuse syndromes have been described, in which patients present clinically with a Guillain-Barré like syndrome [40,41]. Cases of papilledema and increased intracranial pressure (pseudotumor cerebri) have been reported as a complication of Lyme disease, particularly in children [17,42]. There have also been a number of reports describing adult patients with a motor neuron disease and *B. burgdorferi* seropositivity, resembling amyotrophic lateral sclerosis [43-45]. There can be acute or subacute presentations of a myelopathy, leading to a spastic paraparesis with a CSF pleocy-

toxis. Patients can thus have a clinically confusing picture of both upper and lower motor neuron signs. There are also few reports of acute and recurrent hemiparesis in patients of all ages, occurring as a result of Lyme disease, manifestations of cerebrovascular neuroborreliosis and ischemia, probably secondary to a vasculitis, with symptoms responding to antibiotic therapy [46-48]. There have also been a few published cases of intracranial hemorrhage, both subarachnoid and intraparenchymal, associated with Lyme neuroborreliosis [49-51].

PATHOGENESIS

The mechanisms by which *B. burgdorferi* injures such a large number of tissues are unclear. In contrast to other pathogenic microorganisms, *B. burgdorferi* does not produce specific toxins, elicit a significant inflammatory reaction, or produce a cellular infiltrate. The immunopathogenesis of Lyme disease may result from the immunomodulation of host cells by *Borrelia* components, an increase in the pathogenicity of the organism by the cytokine-rich local environment, and possible autoimmune reactions during the course of infection. The best animal model of the neurologic manifestations of Lyme disease has been the rhesus macaque monkey. As in humans, epineurial perivascular inflammatory infiltrates are evident, without demonstrable spirochetes, immune complexes, or other clear evidence for an underlying mechanism [26]. The only clue has come from the demonstration, by immunocytochemistry, that some intraneural macrophages contain *B. burgdorferi*. The lack of compelling evidence of a direct infection of peripheral nerves, for example, has led to speculation about cross-reactivity between spirochetal and peripheral nerve epitopes. One group of investigators has demonstrated that a monoclonal antibody directed against *B. burgdorferi* flagellin binds to axonal cytoplasm, and, in vitro, slows neurite outgrowth from cultured cells [52]. Other studies have shown that not only does *B. burgdorferi* bind to gangliosides, but animals immunized with this organism produce antiganglioside antibodies, which can bind antigens at the nodes of Ranvier [53,54]. Similar antibodies have been observed in the sera of infected patients.

DIAGNOSIS

Diagnosis is often made clinically, with or without ancillary laboratory testing. Of particular difficulty is the diagnosis in late neuroborreliosis because the clinical features are nonspecific, the initial diagnosis of Lyme disease may be erroneous, and the response to therapy is often delayed. Late Lyme disease can occur in patients with no prior history of the disease and who are no longer in a Lyme disease-endemic area. As a result, a travel history and questioning about prior residences in endemic areas may be crucial in considering the diagnosis of late Lyme disease. The CDC criteria for a diagnosis of Lyme disease-associated facial nerve palsy, for example, is based on the immunoreactivity demonstrated in peripheral blood [6]. The *Borrelia* seropositivity, however, does not differentiate between active infection or past exposure [25]. In endemic areas, it is estimated that at least 5 to 10% of the population may be seropositive [23]. *B. burgdorferi* seropositivity, as determined by ELISA, may also reflect cross-reactivity with other antigens, which could result in false positivity. For this reason, the CDC

has recommended that a confirmatory Western blot analysis be performed if the ELISA result is borderline or positive.

CSF analysis, however, is mandatory in the evaluation of a patient with presumed central nervous system Lyme disease, even isolated facial palsy, since results may effect treatment. The CSF concentration of antibody to *B. burgdorferi*, compared to serum levels, is probably a more sensitive and specific method of making the diagnosis of CNS Lyme disease than serum antibody titers alone. Early negative blood serology does not exclude the diagnosis of Lyme disease; the IgM response usually peaks during the 3rd to 6th week and IgG antibody typically rises after the 4th week [55]. Serologic testing should, hence, consist of an ELISA coupled with immunoblot, if the ELISA is positive.

Dominant CSF IgM synthesis in neuroborreliosis yields a high specificity of 96% with a sensitivity of 70% for the disease, even in the absence of a *Borrelia*-specific antibody index (AI) [56]. Nonetheless, an elevated *Borrelia*-specific AI is useful for diagnosis, increasing the sensitivity from 70 to 80% [56]. The PCR in CSF for *B. burgdorferi* has a diagnostic sensitivity below 40% and does not improve the overall sensitivity obtained and qualitative analysis with Western blot is also less sensitive than AI for detection of neuroborreliosis [57]. PCR does not differentiate between live and dead organism, and cannot be used to prove active infection [58]. The organism has also been grown from CSF samples, but not a very sensitive test and should not be used to make the diagnosis of Lyme disease [3].

TREATMENT

Antibiotics are the treatment for active *B. burgdorferi* infection as delineated by the practice guidelines from the Infectious Diseases Society of America and endorsed by the American Academy of Pediatrics for the treatment of Lyme disease [59]. The clinical features and stage of the disease determine the type of antimicrobial therapy, with the goal of halting current features and preventing progression to later manifestations of Lyme disease, although treatment may not decrease the duration or severity of the nonspecific features of early disease. Oral agents, usually amoxicillin (500 mg three times daily in adults, and 25 to 50 mg/kg/day, divided every 8 h for children), doxycycline (100 mg twice daily for adults and 1 to 2 mg/kg twice daily for children), or cefuroxime axetil (500 mg twice daily for adults, and 30 mg/kg/day in two divided doses for children) are adequate for all cases of early, localized disease, regardless of the severity of the patient's complaints or the antibody level [60]. Since cefuroxime axetil is more expensive than the other drugs, and is not demonstrably better, it is not recommended as first line-therapy. Doxycycline is also contraindicated in children less than 8 years of age or for pregnant women. Most of the randomized, controlled trials of therapy for early localized Lyme disease have recommended a treatment duration of three weeks [60]. Other studies, however, have suggested 10 to 14 days of therapy to be as effective [61,62].

Intravenous (IV) therapy with a third generation cephalosporin, ceftriaxone (2 g once daily) or cefotaxime (2 g three times per day), may be indicated for certain features of Lyme disease, including early disseminated and late Lyme disease, given for two to four weeks. No other parenteral agents are of proven value as alternative or additional therapy. In particular, IV antibiotic therapy is indicated for early neurologic disease,

with the exception of seventh nerve palsy, which can be treated with oral antibiotics, if the CSF reveals no inflammatory changes and there are no other objective neurologic findings. For this reason, it is hence recommended that patients with facial palsy suspected of being due to *B. burgdorferi* infection undergo a lumbar puncture with CSF analysis to identify specific antibodies or inflammatory cells, either of which would be suggestive of CNS Lyme disease and requiring IV therapy. Four weeks is the current standard in many centers, although there is no evidence to support greater efficacy of four versus two weeks. There is also no evidence that treating for more than four weeks is beneficial. There is furthermore no evidence that treatment of asymptomatic seropositive individuals is beneficial. If the infection fails to respond to the initial therapy, a second course of antibiotic treatment is warranted.

In a retrospective pediatric cohort study of 63 patients with Lyme disease who were appropriately treated, there was no sequelae of borreliosis 1 to 6 years (mean, 3.5 years) later [63]. Furthermore, in a prospective, controlled investigation of the cognitive skills of children previously treated for Lyme disease, there was no impairment in cognitive functioning [64].

Nonspecific complaints such as headache, fatigue, arthralgias, myalgias, subjective perception of memory and cognitive difficulty and problems with concentration, may persist after treatment of Lyme disease, often lingering for months with slow spontaneous resolution [31]. In contrast to adults who following a borreliosis infection may have these debilitating symptoms, children rarely complain of fatigue or problems with attention, concentration, or memory [17]. Such nonspecific complaints, when they occur, do not require further antibiotic treatment. Several studies have demonstrated that even prolonged courses of antibiotics do not affect these symptoms [65,66].

CONCLUSIONS

Lyme disease, the most frequent arthropod-borne infection in North America and Europe, continues to be a growing problem throughout the world as a major public health issue, especially for children residing in endemic areas. Neuroborreliosis can affect both central and peripheral nervous systems, whether early in the course of the disease, or later. More commonly involving the central nervous system (meningitis with involvement of the cranial nerves) in children, and the peripheral nervous system (radiculopathy, plexopathy, mononeuropathy, cranial neuropathies, diffuse polyneuropathies, entrapment neuropathies, and possibly motor neuron disease) in adults. This discrepancy in clinical manifestation of the disease between children and adults may be in part be due to the difference of inoculation site by the vector. EM lesions, for instance, are more likely to be on the head or neck in younger children and on the arms and legs in older children and adults [13,30]. Some reports have found a greater incidence of acute neurologic manifestations in children as opposed to adults [14,15], whereas others have reported the same range [18]. Undisputed, however, is the fact that the incidence of Lyme disease is highest in children, with a predominance of boys to girls [13,18,30]. Unlike adults, in the pediatric population painful lymphocytic meningoradiculitis (Garin-Bujadoux-Bannwarth syndrome) is infrequent, peripheral nervous system syndromes are uncommon, and chronic encephalopathy is rare [14]. Of the neurologic problems related to Lyme disease in children, facial palsy is the most frequent neurologic

complication, followed by aseptic meningitis [14,17,18]. Less common manifestation of neuroborreliosis in children are sleep disturbance and papilledema with increased intracranial pressure [17].

Because of the high frequency of Lyme borreliosis in peripheral facial palsy in children, CSF examination including serological testing for antibodies against *B. burgdorferi* should be performed in all cases, even in the absence of other signs/symptoms. In patients with CSF pleocytosis, Lyme borreliosis has to be suspected unless proven otherwise [25,30]. Hence, all children with Lyme-induced facial nerve palsy should have a CSF analysis; those with abnormalities consistent with CSF infection should be treated with intravenous antibiotic therapy as for others with early disseminated Lyme disease. Latent infection is a well-recognized complication of these infections, and symptomatic neurologic involvement may occur

after quiescent periods. Animal models show that *B. burgdorferi* can seed the CNS early in infection [67,68]. It is, as of yet, uncertain if untreated or partially treated early infection may recur at a later time, due to reactivation of sequestered organisms. It is important to diagnose and treat children with Lyme disease at the early stage, as it is believed that human spirochetal infections respond best at this time to antimicrobial agents. The mechanism underlying the neurologic involvement remains unclear, although an immune-mediated processes between anti-borrelial antibodies and neuronal proteins, in particular several peripheral nerve constituent molecules, raise intriguing possibilities as to the pathogenesis of Lyme disease [26,69,70]. Continued investigations are needed to clarify the precise relationship between this clinical syndrome, with a variety of neurologic manifestations, CSF changes, and systemic and intrathecal immunologic responses to *B. burgdorferi*.

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NEUROBORRELIOSIS Y LA POBLACIÓN PEDIÁTRICA: UNA REVISIÓN

Resumen. Objetivo. Revisar la bibliografía médica relacionada con la neuroborreliosis, centrándose en la clínica que presenta tanto en los adultos como en los niños, y destacar las diferencias entre los dos grupos, con especial atención a la población pediátrica. Desarrollo. Las manifestaciones neurológicas de la enfermedad afectan a diferentes zonas del neuroaxis, central o periféricas, y se pueden presentar con una sintomatología precoz o tardía, según el grupo de edad. Aunque la bibliografía recoge una amplia gama de alteraciones neurológicas, el síntoma más frecuente descrito en la población pediátrica es la cefalea, y el signo más común es la parálisis facial. La existencia de un proceso inmunológico con anticuerpos interactivos y anticuerpos dirigidos contra las proteínas neuronales puede ser el factor etiológico. Dados los signos característicos en el líquido cefalorraquídeo, los análisis de éste y las pruebas serológicas de *Borrelia burgdorferi* —el agente causal—, deben realizarse en pacientes (sobre todo si se trata de niños) que han estado en una zona endémica y presentan una afectación neurológica aguda con una etiología desconocida. Si se instaura precozmente, el tratamiento con antibióticos logra buenos resultados, sobre todo en los niños. Conclusiones. La población infantil, comparada con los otros grupos de edad, ofrece el mayor riesgo de padecer la enfermedad de Lyme. El cuadro tiende a ser más agudo en los pacientes más jóvenes, con afectación del sistema nervioso central y manifestación de una respuesta inflamatoria en el líquido cefalorraquídeo y signos/síntomas de meningitis aséptica y parálisis del nervio facial; los pacientes más mayores presentan una afectación del sistema nervioso periférico, con una radiculopatía. A pesar de tener mayor incidencia de neuroborreliosis, la evolución clínica en la mayoría de los niños es más leve y corta que la que se describe en el caso de los adultos. [REV NEUROL 2006; 42 (Supl 3): S91-6]

Palabras clave. *Borrelia burgdorferi*. Enfermedad de Lyme. Neuroborreliosis. Neurológico. Niños. Pediátrico.

NEUROBORRELIÓSE E A POPULAÇÃO PEDIÁTRICA: UMA REVISÃO

Resumo. Objectivos. Rever a literatura médica sobre a neuroborreliose, em particular as suas características clínicas tanto em adultos como em crianças, e enfatizar as diferenças entre os dois grupos com destaque para a população pediátrica. Desenvolvimento. As manifestações neurológicas da doença afectam de forma variável os neuroaxónios, centrais ou periféricas, e podem apresentar sintomatologia precoce ou tardia, dependendo do grupo etário. Embora a literatura inclua um vasto leque de anomalias neurológicas, o sintoma mais frequente reportado pela população pediátrica é a dor de cabeça e o sinal mais comum é a paralisia facial. Um processo imunológico com reacções cruzadas de anticorpos e de anticorpos dirigidos contra as proteínas neuronais pode existir como factor desencadeante. Devido aos resultados característicos no líquido cérebro-espinal, devem se efectuar testes serológicos para a *Borrelia burgdorferi* —o agente causador—, nos doentes, sobretudo em criança que tenham estado numa área endémica, evidenciar uma perturbação neurológica aguda de etiologia inexplicável. O tratamento com antibióticos, se iniciado atempadamente, é curativo, sobretudo nas crianças. Conclusões. A população pediátrica apresenta um risco mais elevado para a doença de Lyme que outros grupos etários. Os doentes mais jovens tendem a ser afectados mais intensamente, com envolvimento do sistema nervoso central, exibindo uma resposta inflamatória no líquido cérebro-espinal e sinais/síntomas de meningite asséptica e paralisia do nervo facial, enquanto que os doentes mais velhos apresentam um envolvimento do sistema nervoso periférico, com radiculopatía. Apesar de terem maior incidência de neuroborreliose, o quadro clínico da maioria das crianças é mais moderado e mais curto que o verificado nos adultos. [REV NEUROL 2006; 42 (Supl 3): S91-6]

Palavras chave. *Borrelia burgdorferi*. Crianças. Doença de Lyme. Neuroborreliose. Neurológica. Pediátrica.