

Lyme Neuroborreliosis: A case report

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Abstract

Central nervous system (CNS) infections constitute a significant etiology of seizures. However, the likelihood of such infections is contingent upon factors such as age, immunological status, and geographic region. *Borrelia burgdorferi*, a Spirochaete, is responsible for the infectious etiology of seizures in Lyme disease. The case under consideration pertains to a patient who exhibited seizures as the initial manifestation of neuroborreliosis. A male patient, aged 55, was admitted to the emergency department due to the sudden onset of tonic-clonic seizures. All standard laboratory examinations yielded unremarkable outcomes, except a favorable Wright and 2-mercaptoethanol test. The examination of cerebrospinal fluid revealed the presence of 380 white blood cells per milliliter. Additionally, the protein level was elevated, while the glucose level was within the normal range. The results of the serologic tests indicated the presence of both IgG and IgM antibodies to *B. burgdorferi*. Following the administration of ceftriaxone, a significant improvement was observed in the patient's medical status, and he was subsequently discharged.

Keywords: Central Nervous System Infections; Borrelia Infections; Lyme Neuroborreliosis

Key Clinical Message

Lyme neuroborreliosis is the manifestation of Lyme borreliosis that impacts the nervous system. It gives rise to various neurological and psychiatric conditions, and its diagnosis is challenging. The timely administration of antibiotics is effective.

Introduction

Central nervous system (CNS) infections are a major cause of seizures worldwide. Infectious causes of convulsions vary according to geographical location. Nevertheless, globalization and international travel have broken the boundaries, so we can expect any infection to cause seizures in different parts of the world [1]. Bacterial meningitis, malaria, herpes simplex virus (HSV), human immunodeficiency virus (HIV), tuberculosis, toxoplasmosis, and neurocysticercosis are infectious etiologies of seizures. Nevertheless, their probability as the cause of seizures depends on the age and immunologic condition of the patient and geographical location [2]. Lyme disease is another infectious cause of seizures caused by the Spirochaete, *Borrelia burgdorferi*. The condition, known as neuroborreliosis, may occur at the early or late stages of this disease and can even be its first presentation. Other neurologic manifestations of borreliosis include cranial neuritis, facial palsy, radiculoneuritis, pseudotumor cerebri, myelitis, cerebellar ataxia and spastic paraparesis [3]. Lyme disease is rarely suspected as the cause of neurologic manifestations in Iran since most cases have been reported in America and Europe. Here, we present a case of neuroborreliosis with seizures as the first manifestation in a 55-year-old man.

Case presentation

A 55-year-old man was admitted to the emergency department with new-onset tonic-clonic generalized seizures. At the time of admission, he was in the postictal phase. Soon after, his consciousness level deteriorated, and he was intubated. His symptoms began one week prior to presentation with a mild headache and low-grade fever, malaise, anorexia and vomiting. Four days before admission, he developed his first convulsive episode and was hospitalized. However, he was discharged with personal consent. He had no history of recent trauma, drug overdose, or travel. The patient was a butcher and had been treated for brucellosis two times in recent two years. Neurologic examination was unreliable due to decreased level of consciousness. Hypoglycemia and opium overdose were excluded for the patient at admission, and he was started on anticonvulsive therapy and broad-spectrum antibiotics.

Routine laboratory tests had normal results, except for a positive Wright and 2-mercaptoethanol (2ME) tests results (Wright: 1:80, normal range: [?] 1/160; 2ME: 1:40, normal range: [?] 1/160). Thyroid function tests, vitamin B12 and folate, creatine kinase (CK), and C-reactive protein (CRP) levels and erythrocyte sedimentation rate (ESR) were in normal ranges. Autoantibodies, anti-HIV antibodies, and rapid plasma reagin (RPR) tests were also negative. Chest computed tomography (CT) scan demonstrated centrilobular opacities at the lower segments of both lungs, indicative of aspiration pneumonia. A brain CT scan showed a subarachnoid cyst in the left cerebellar hemisphere and opacification and air-fluid levels in both maxillary paranasal sinuses. Brain magnetic resonance imaging (MRI) revealed bilateral hypersignal changes on the parietal lobes. Cerebrospinal fluid (CSF) examination showed white blood cells (WBCs) of 380/mL (normal range: < 5/mL) with 68% lymphocytes, an elevated protein level (82 mg/dL, normal range: 15-60 mg/dL), and a normal glucose level. CSF gram stain, culture, and polymerase chain reaction (PCR) tests were negative for HSV and *Mycobacterium tuberculosis*. The patient was first suspected to be a case of neurobrucellosis.

Nonetheless, the presence of CSF pleocytosis with lymphocyte dominance and inconclusive Wright and 2ME tests results ruled out this diagnosis, and therefore, we suspected Lyme disease. Thus, we requested serologic tests, which were positive for IgG and IgM antibodies to *B. burgdorferi*. Because of the high prevalence of cardiac and ocular involvement in the settings of Lyme disease, we requested a cardiology and an ophthalmology consultation. However, no abnormality was found. The patient was started on ceftriaxone at a dose of 2 g daily. His condition improved dramatically during the following days, and he was discharged three weeks after admission with a favorable general condition.

Discussion

Borreliosis is a tick-borne infection caused by Spirochetes of *Borrelia* species. Depending upon the geographical location, the most common causative agents for Lyme disease includes *B. burgdorferi* and *B. garinii*. This spirochetal infection occurs as a result of a tick bite. However, in disseminated or late infection, many

patients do not recall the insect bite [4, 5]. Neurological manifestations of Lyme disease, known as neuroborreliosis, occur in up to 50% of borreliosis cases. Neurological involvement of Lyme disease can present in various forms, ranging from simple neuropathy, neuritis or facial palsy to seizures, psychosis, paraplegia, meningoencephalitis, radiculomyelitis, and stroke [6-9]. Convulsion was our patient's main manifestation, resulting from meningoencephalitis.

Diagnosis of Lyme disease is suspected in individuals with compatible manifestations like characteristic cutaneous features (erythema migrans, acrodermatitis chronica atrophicans, malar rash), musculoskeletal presentations (migratory pain in the joints and muscles, arthritis, panniculitis), neurologic symptoms (meningitis, ataxia, neuritis, radiculopathy), cardiac complications (myopericarditis, AV block, cardiomegaly) and ophthalmic abnormalities (iritis, keratitis, conjunctivitis). However, paraclinical evaluation should confirm the diagnosis [10-12]. CSF changes in Lyme disease with CNS involvement are expected to include a pleocytosis, usually with lymphocyte dominance, elevated protein, and normal glucose levels [13, 14]. Microbiological tests (e.g., culture) and molecular tests (e.g., PCR) yield low conclusive results in neurologic involvement of Lyme. Hence, the definite diagnosis is based on serologic tests and a demonstration of the patient's immune response [15]. Our patient was suspected of neuroborreliosis due to aseptic meningitis with lymphocyte dominance. Hence, we requested serum anti-Borrelia antibodies (IgM and IgG) tests, both positive in high titers.

Nevertheless, the Western blot test should have been used as a secondary test to exclude reactive IgG false positivity. However, due to our inaccessibility to this confirmatory test, we started the patient on Lyme treatment based on the initial ELISA positivity. Increased oligoclonal bands in the CSF have also been reported to suggest neuroborreliosis [16], but it was not performed due to resource shortage. On the other hand, some authorities only accept intrathecal anti-Borrelia antibody production (ITAb) as the confirmatory diagnostic test for neuroborreliosis [17]. Unfortunately, serological evaluation of Borreliosis was not performed on our patient's CSF. Recently, an increase in CXCL13 levels in the CSF and positive Borrelia C6 peptide reaction have been suggested to be beneficial diagnostic markers for neuroborreliosis [18, 19]. It should be acknowledged that CSF pleocytosis, with lymphocytes dominance, also known as aseptic meningitis, has several other differential diagnoses, including viral CNS infections, late stages of tuberculosis meningitis, neurobrucellosis, neurosyphilis, HIV infection, listeriosis, convulsion, subarachnoid hemorrhage (SAH), neuroimmunologic and neurodegenerative disorders, neoplasms, and vasculitis [20]. Nevertheless, most of these diagnoses were excluded with corresponding laboratory tests in our patient.

The treatment response of neuroborreliosis is more satisfactory with intravenous antimicrobials. Ceftriaxone or penicillin G, alternatively, are the most appropriate options, but oral doxycycline could also be used [21]. Our patient responded favorably to antibiotics, improving his condition within two weeks.

Conclusion

Lyme neuroborreliosis is Lyme borreliosis affecting the nervous system. It can be difficult to diagnose unless it presents with typical symptoms, and clinicians actively consider this diagnosis. If left untreated, this disease can affect any part of the nervous system, including the brain. It causes a wide range of neurological and psychiatric disorders. There is no gold standard test that can be relied upon for diagnosis. This illness can be successfully treated if treatment starts early with antibiotics.

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Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of interest disclosure

All authors have no relevant financial interests to be declared.

Author Contributions

- **BS:** Data collection and writing of the manuscript.
- **AB:** Data collection and writing of the manuscript.
- **MB:** Data collection, helped with manuscript writing, and contributed substantial revisions to the manuscript's content.
- **RH:** Data collection and writing of the manuscript.
- **SE:** Data collection and writing of the manuscript.
- **ZMA:** Design of the research study and supervision

Informed consent

Written informed consent was obtained from the patient to publish the current case report.

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