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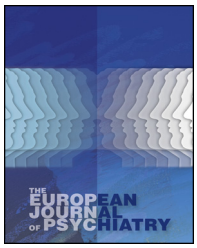

ORIGINAL ARTICLE

Anxiety and depression in patients infected with *Borrelia burgdorferi*

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Abstract
Background and objectives: The aim of the study was to evaluate the symptoms of depression and anxiety associated with fibromyalgia and *erythema migrans* in *Borrelia burgdorferi* infection.
Methods: A group of 87 patients with clinically and serologically diagnosed *B. burgdorferi* (mean age 53.37) was formed. They were examined using the State-Trait Anxiety Inventory, Beck's Depression Inventory and various immunological tests, as well as for fibromyalgia. A demographic survey with additional questions was also administered.
Results: Our results confirm that fibromyalgia is associated with higher anxiety and depression symptoms. It is possible that serological markers of infection could act as indicators of depression level in patients with *B. burgdorferi*. The examined patients with *B. burgdorferi* infection reported a low prevalence of anxiety and depression symptoms.
Conclusions: The studied population is not very likely to experience neurologically-determined mood disorders, taking into consideration the above-mentioned results.

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Introduction

Lyme borreliosis is a multisystem inflammatory anthropozoonosis caused by a complex interaction between the spirochete *Borrelia burgdorferi sensu lato* (*B. burgdorferi* s.l.) and the immune system of the infected individual at the site of infection.[1]

Annually, more than 25,000 new cases of Lyme disease are diagnosed in the USA (incidence 7.9/100,000), and around 85,000 in Europe.[2] The NIZP-PZH, the Polish National Institute of Public Health-National Department of Hygiene, reports that the incidence of *B. burgdorferi* infection in Poland increased by almost 50% in the period 2011–2014.[3] Although in Poland, the incidence varies according to province, it was found to be 39.7/100,000 for the whole of Lublin province in 2014.[4]

The epidemiology of tick-born disease depends on a number of factors, including the specificity of natural resources and type of employment in the region, with Eastern Poland being one of the more exposed regions in the European Union.[4]

The symptomatology of the *B. burgorferi sensu lato* complex varies according to the species of *Borrelia* present. Eighteen species have been diagnosed, with individual types characterized by different tissular affinity: i.e. neural system or dermal, generalized or particular; a high level of pathogenicity has been found in three species.[5] All types can cause the occurrence of a primary lesion known as *erythema migrans*. A diagnosis of borreliosis must take into account the epidemiological aspect, the tick bite, the clinical aspect and the serological aspect, with a two-step diagnostic procedure based on an immune enzymatic test and Western blotting.[6] The disease is characterized by a multiorgan symptomatology and differentiated clinical picture, which can be attributed to, among other things, its considerable adaptability to the human organism.[5]

Asbrinkn and Hovmark[7] define three clinical pictures of infection: early local type, early disseminated type and late type. The early local type is present in half the patients as *erythema migrans* between three and 30 days following infection. The early disseminated type can develop several days or months following the bite: some symptoms from central nervous system can appear, sometimes without signs of *erythema migrans*. Late treatment of early types can result in numerous consequences: changes in the osteoarticular system in 60% of cases, neurological symptoms (i.e. mildly declined executive cognitive functions) in 10–40%, and cardiological complications in 5%,[8,9] which can lead to a prolonged decline in the health-related quality of life.[10]

An important potential comorbidity observed in patients with borrelia is fibromyalgia: a conditions manifested by widespread pain and which known to intensify mood and sleep disturbances.[11] Fibromyalgia could be considered an additional burden triggered by Lyme borreliosis which affects psychological function.[12] Chronic Lyme disease is another irrelevant and controversial term used to diagnose a broad spectrum of diverse, medically unexplained symptoms.[13] From a methodological perspective, evidence-based studies should refer to *B. burgdorferi* infection rather than CLD, and recognize the existence of early Lyme Borreliosis as a condition instead of using it as a basis for the diagnosis of Chronic Lyme disease.[14]

Most of the mental disorders experienced during early Lyme disease are considered to be the direct consequences of an inflammatory state in neural tissue and the psychological consequence of chronic illness. Mental symptoms are not specific for neuroborreliosis, although they have been observed during various stages of the infection.[15] Several ill-conceived studies suggest that the early stage of borreliosis can present symptoms typical for fibromyalgia and mild depression, while the late stage may manifest Lyme encephalopathy characterized by symptoms of memory deficits, fatigue, spatial disorientation and mood disturbances.[16]

The co-occurrence of fibromyalgia and *B. burgdorferi* infection can also be problematic in determining whether the presentations of these illnesses are associated with depression or anxiety symptoms. The nonspecific chronic syndromes observed in some patients seem to have an unknown medical explanation. Many complaints remain subjective and resistant to medical treatment.[17] Generally, the adjustment to chronic disease itself is regarded as a dynamic process which is challenging enough to a sick person, and one which depends on the individual characteristics of the patient and the quality of healthcare, including accurate diagnosis and treatment.[18] It is argued that some patients with recognized Lyme disease are incorrectly diagnosed due to comorbidities and the atypical presentation of symptoms.[19] A further point of controversy is whether patients diagnosed with Lyme disease also suffered from mental disorders before the diagnosis.

The aim of this research was to learn how the factors accompanying *B. burgdorferi* infection such as fibromyalgia or *erythema migrans* were associated with self-reported anxiety and depression comprising the majority of affective disorders. Additionally, the objective was to investigate whether Western-blot tests might predict the level of anxiety and depression symptoms in *B. burgdorferi* infection. It was hypothesized that:

1. Patients diagnosed with *B. burgdorferi* infection associated with fibromyalgia would report a higher level of anxiety and depression than patients without fibromyalgia.
2. Patients diagnosed with *B. burgdorferi* infection associated with *erythema migrans* would report a higher level of anxiety and depression than patients without *erythema migrans*.
3. There would be a relationship between Western blot IgM/IgG (immunoglobulin M/immunoglobulin G) test results and the level of anxiety and depression in patients with *B. burgdorferi*.

Materials

Patients diagnosed and treated for *B. burgdorferi* infection were recruited at the Outpatient Clinic, Department of Infectious Diseases, Medical University of Lublin. In total, 87 participants (43 females and 44 males) completed the study, including psychological diagnosis, medical record analysis, medical interview with demographic questions and additional medical tests. The overall response rate of 87% was achieved by encouragement from academics and keeping

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