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Mini Review

The Application of a Spreadsheet Algorithm for Use by Physicians for Evaluating Patients Manifesting Alzheimer's Symptoms in Areas Endemic for Lyme and Other Tick Borne Infections

Robert-A Ollar[1,2]*

[1]*Clinical Assistant Professor of Neurology, Department of Neurology, New York Medical College, Valhalla, New York, USA*

[2]*Consulting Microbiologist, TBD Support Network Inc., Milford, Pennsylvania, USA*

***Corresponding Author:** Robert-A Ollar, Clinical Assistant Professor of Neurology, Department of Neurology, New York Medical College, Valhalla, New York, USA.

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"The application of a data input spreadsheet algorithm would thus enable a Physician to make a more accurate diagnosis that would enable him or her to identify Alzheimer's Disease from Lyme Neuroborreliosis mimicry and thus lessen the chance of misdiagnosis"

Abstract

It is important to be able to distinguish Alzheimer's Disease from Lyme Neuroborreliosis. Lyme Neuroborreliosis can be treated with antibiotics if detected in the early stages. There isn't any cure for Alzheimer's Disease at the present time. Markers for Alzheimer's Disease include monitoring levels, of beta amyloid tau, phospho tau and chemokines (CCL2, CXCL8 and CXLC10) in the CSF. Markers for Lyme Neuroborreliosis manifesting Alzheimer's symptoms include monitoring the presence of intrathecal antibodies, and the presence of the cytokine CXCL13 in the CSF. The use of a data input spreadsheet algorithm would thus enable a physician to make a more accurate evaluation in order to distinguish between Alzheimer's Disease from Lyme Neuroborreliosis manifesting Alzheimer's like symptoms. The data input spreadsheet algorithm would be especially useful for a physician in areas endemic for Lyme and other Tick Borne Diseases.

Keywords: *Alzheimer's Disease; Lyme Neuroborreliosis; Tick Borne Diseases*

It is important for Physicians to be able to distinguish Alzheimer's Disease from Lyme Neuroborreliosis, manifesting Alzheimer's Symptoms. This latter Tick Borne illness can be treated with antibiotics in the early stages. It has been stated, "Like its close spirochetal cousin *Treponema pallidum, Borrelia burgdorferi* can cause disabling neurological manifestations, and present a puzzling diagnostic challenge" [1].

The emotional trauma to patients and their loved ones that result when Lyme Neuroborreliosis has been misdiagnosed as Alzheimer's Disease is devastating. Thus, the greatest effort must be made to avoid such a misdiagnosis. The noted country and western music star Mr. Kris Kristofferson has become a Poster Child for Lyme Neuroborreliosis which had been misdiagnosed as Alzheimer's Disease (CBS News July, 2016: Kris Kristofferson's Lyme Disease misdiagnosed as Alzheimer's Disease).

A diagnosis of Lyme Neuroborreliosis is confirmed by the presence of "intrathecal antibodies" to *Borrelia burgdorferi* [2]. A diagnosis of Alzheimer's disease is substantiated by monitoring the of levels of beta-amyloid, tau, and phosphor-tau, markers present in the CSF (See table 1).

Beta-amyloid	Tau	Phospho-tau

Table 1: *Classical markers in Alzheimer's disease.*

More recently, a confirmation of Alzheimer's Disease has been further substantiated by the presence in the CSF of specific chemokines found at early stages of Alzheimer's Disease [3] (See table 2).

The expression the chemokine CCL2 was found to increase in patients with Alzheimer's Disease [3]. A positive correlation between the beta amyloid levels and the chemokines was observed [3]. A positive correlation also was found between the CCL2 and p-tau levels [3]. An additional finding was that the CCL2 Chemokine is present in the CSF, and was involved in the pathogenesis of Alzheimer's Disease [3]. Thus, CCL2 can be a useful additional marker in the monitoring of Alzheimer's Disease progression [3]. Thus, the chemokines CCL2, CXCL8, and CXCL10 are indicative of Alzheimer's Disease (See table 2).

CCL2	CXCL8	CXCL10

Table 2: *Chemokines in CSF in early stages of Alzheimer's disease.*

Lyme Neuroborreliosis and Lyme Neuroborreliosis concurrent with Alzheimer's Disease can invade the brain and remain there for years subsequently causing a dementia state [4]. There are an undetermined number of patients with Alzheimer's Disease that also have late Tertiary Neuroborreliosis [4].

Miklossy., *et al.* have found patients with concurrent Alzheimer's Disease and Lyme Neuroborreliosis [5]. Recovery of the cognitive decline in a patient with Lyme Disease and Alzheimer's Type Dementia occurred following treatment with an antibiotic [5]. As had been previously cited above, currently a Lyme Neuroborreliosis diagnosis is based upon "intrathecal production of antibodies" [2].

A new a promising development is the presence of a specific Cytokine which is found in the CSF of patients with Lyme Neuroborreliosis and Neurosyphilis. The Chemokine CXCL13 is at present the best biomarker of Lyme Neuroborreliosis [2].

This cytokine is found in the CSF of Patients with Lyme Neuroborreliosis and Neurosyphilis CXCL13 (found at higher levels in these two disease states (tertiary syphilis is not commonly seen in the 21st Century)) (see table 3).

CXCL13 (found at higher levels Lyme Neuroborreliosis and Neurosyphilis (Neuro or Tertiary syphilis is not commonly seen in the 21st Century)

Table 3: *Cytokine found in the CSF of patients with lyme neuroborreliosis and neurosyphilis.*

In cases of dementia like syndromes associated with Lyme borreliosis the causative agent, *Borrelia burgdorferi*, could cause or even trigger primary dementia such as Alzheimer's Disease [6]. Kristoferitsch., *et al.* found that "the response to 2 - 4 weeks of an antibiotic treatment with ceftriaxone was excellent [6]. An extremely important point that Kristoferitsch., *et al.* put forth is that it is "crucial to be aware of the possibility of the occurrence of Lyme Neuroborreliosis because early antibiotic treatment will prevent "permanent sequelae that may occur throughout the further course of the untreated disease" [6].

The information cited above can be put into spreadsheet algorithm that can be easily created by using a Microsoft Word software program (See table 4). The data put into a spreadsheet format thus provides a physician with a user friendly method for having a global view of relevant data for evaluating Alzheimer's Disease patients in areas endemic for Lyme and other tick borne infections (see table 4). This also serves as a convenient way for the Physician to distinguish Alzheimer's Disease from Lyme Neuroborreliosis manifesting Alzheimer's like clinical symptoms [6,7].

The use of a data input spreadsheet would be especially useful in cases concurrent Alzheimer's Disease and Lyme Neuroborreliosis mimicry. The input data information seen on the spreadsheet would further facilitate the Physician's ability to observe the simultaneous presence of Alzheimer's Disease and Lyme Neuroborreliosis mimicry (See table 4).

Patient ID Code	Age	Sex	Alzheimer's Disease confirmed by the Presence of Classical Markers (beta-amyloid, tau, phosphor- tau, etc.) (enter below with a (+) or (-) symbol	Tests revealed presence of Lyme and other Tick Borne Disease(s) in serum (enter below with a (+) or (-) symbol	Presence of intra-thecal antibodies for Lyme Neuro -borreliosis CSF (IgM, IgM) (enter below with a (+) or (-) symbol)	Presence of Chemokine markers in CSF for Alzheimer's Disease (CCL2, CXCL8, CXCL 10) (enter below the specific chemokines Present)	Presence of the Cytokine marker CXCL13 for Lyme Neuroborreliosis and Neurosyphilis (enter below with a (+) or (-) symbol)

Table 4: *Data input sheet for evaluating Alzheimer's disease patients in areas endemic for lyme and other tick borne infections.*

Interpreting results obtained in table 4

Alzheimer's Disease confirmed by the Presence of Classical Markers (beta-amyloid, tau, phosphor- tau, etc.) (enter below with a (+) or (-) symbol	Tests revealed presence of Lyme and other Tick Borne Disease(s) in serum (enter below with a (+) or (-) symbol	Presence of intra-thecal antibodies for Lyme Neuroborreliosis CSF (IgM, IgM) (enter below with a (+) or (-) symbol)	Presence of Chemokine markers in CSF for Alzheimer's Disease (CCL2, CXCL8, CXCL 10) (enter below the specific chemokines Present)	Presence of the Cytokine marker CXCL13 for Lyme Neuro-borreliosis and Neurosyphilis (enter below with a (+) or (-) symbol)
+	-	-	CCL2, CXCL8, CXCL10	-

Table 4a: *Alzheimer's disease scenario.*

Alzheimer's Disease confirmed by the Presence of Classical Markers (beta-amyloid, tau, phosphor- tau, etc.) (enter below with a (+) or (-) symbol	Tests revealed presence of Lyme and other Tick Borne Disease(s) in serum (enter below with a (+) or (-) symbol	Presence of intra-thecal antibodies for Lyme Neuroborreliosis CSF (IgM, IgM) (enter below with a (+) or (-) symbol)	Presence of Chemokine markers in CSF for Alzheimer's Disease (CCL2, CXCL8, CXCL 10) (enter below the specific chemokines Present)	Presence of the Cytokine marker CXCL13 for Lyme Neuroborreliosis and Neurosyphilis (enter below with a (+) or (-) symbol)
-	+	+	-	+

Table 4b*: Lyme neuroborreliosis clinically manifesting Alzheimer's like symptoms scenario.*

Alzheimer's Disease confirmed by the Presence of Classical Markers (beta-amyloid, tau, phosphor- tau, etc.) (enter below with a (+) or (-) symbol	Tests revealed presence of Lyme and other Tick Borne Disease(s) in serum (enter below with a (+) or (-) symbol	Presence of intra-thecal antibodies for Lyme Neuroborreliosis in CSF (IgM, IgM) (enter below with a (+) or (-) symbol)	Presence of Chemokine markers in CSF for Alzheimer's Disease (CCL2, CXCL8, CXCL 10) (enter below the specific chemokines Present)	Presence of the Cytokine marker CXCL13 for Lyme Neuro-borreliosis and Neurosyphilis (enter below with a (+) or (-) symbol)
+	+	+	CCL2, CXCL8, CXCL10	+

Table 4c: *Concurrent Alzheimer's disease and lyme neuroborreliosis clinically manifesting Alzheimer's like symptoms scenario.*

Conclusion

Thus, it is extremely important for Physicians to be able to distinguish Alzheimer's Disease from Lyme Neuroborreliosis manifesting Alzheimer's Symptoms. This fact is especially important in Tick Borne Disease Endemic Areas.

The application of a data input spreadsheet algorithm would thus enable a Physician to make a more accurate diagnosis that would enable him or her to identify Alzheimer's Disease from Lyme Neuroborreliosis mimicry and thus lessen the chance of misdiagnosis [6,7].

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