

# Correlation of EBV and HHV 6 Viral Titers to Lyme Disease

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## Abstract

### Background:

Lyme disease is diagnosed based on the US Center of Disease control (CDC) criteria, which requires the identification of five Western blot IgG bands.<sup>1</sup> In a previous study, the effect of Lyme disease on the CD4/CD8 ratio was determined. It was noted that the CD8 count lowered, hence the higher ratios. Other Lyme specialists use CD58 (variant of CD8) as a means of evaluating Lyme Disease. Patients with an increased CD4/CD8 ratio also depicted symptoms of fatigue, weakness, and muscle or joint pain.<sup>2</sup> The presence of Lyme disease may cause patients to become immunodeficient as depicted by the high CD4/ CD8 ratios; Therefore, the correlation between certain viral titers with Lyme was evaluated.

### Materials and Methods:

183 patients at two medical centers were evaluated in Lyme endemic communities in Maryland. The CD4/CD8 ratios of 148 of these patients were tested. A viral panel was conducted including EBV and HHV 6 to see whether IgG titers exceeded the expected range. A two tailed t test was performed.

### Results:

Of the 148 patients that were tested for their CD4/CD8 ratios, 105 showed highly elevated EBV levels and 103 showed highly elevated HHV 6 levels, which corresponded to altered CD4/CD8 count. Viral titers for EBV and HHV6 were deemed positive if they exceeded the normal expected range. Applying the null hypothesis, the p-value for EBV IgG and HHV 6 IgG levels on the two-tailed test were p=.00169 and p=.00023 respectively thus, showing that this is not chance occurrence.

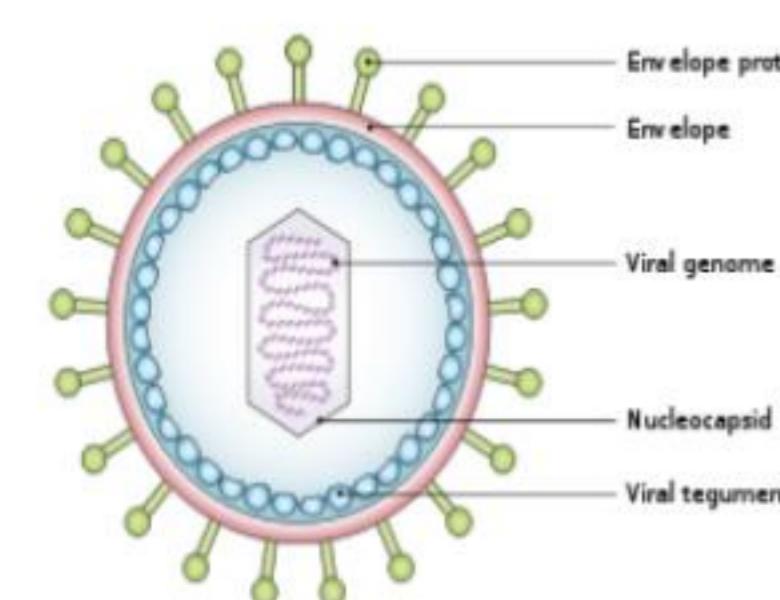
### Conclusions:

Lyme disease further causes immunodeficiencies and symptoms such as fatigue in patients can be correlated to the presence of elevated EBV and HHV 6 viral titers.

## Figure 1. HHV 6 and EBV Viral Titers



HHV 6



EBV

## The Goal

In order to depict that immune deficiency occurs in patients diagnosed with Lyme disease, specific viral titers such as EBV and HHV 6 were analyzed for their prevalence in causing major symptoms such as fatigue, weakness, joint pain, arthritis, and loss of memory.

## Methods

- 183 Patients at two medical centers were evaluated in two Lyme endemic communities of Maryland, US
- 148 of these patients were identified and their medical records were used to collect data on their immunological tests, including IgG and IgM panel, CD4/CD8 ratio, and EBV and HHV 6 levels
- Patients with Lyme Disease, but without a full immunological panel done for each episode of illness, were excluded from this study
- Statistical data analysis (two tailed T test in which the p value was determined) was done on all patients with increased EBV and HHV 6 levels correlating the CD4/CD8 ratios.

## Results

- Strongest data with the largest sample size was found for the EBV- IgG band and HHV6 - IgG band.
- 105 and 103 of these patients had elevated EBV and HHV 6 viral titers respectively. The average CD4/CD8 ratio of the patients with elevated EBV and HHV 6 were 2.41 and 2.50 respectively
- According to literature a normal CD4/CD8 ratio is 2. This corresponded to the hypothesized mean. With a 5% confidence interval, the p-value on the two-tailed test was found to be p = .00169 and p = .00023 for EBV and HHV6 titers respectively.
- This p-value was statistically significant (less than .05), there was enough evidence to reject the null hypothesis

## Hypothesis

- Null – There is no correlation between the presence of EBV and HHV 6 Viral Titers and Lyme Disease
- Experimental – The presence of HHV 6 and EBV viral titers shows a statistically significant increase in CD4 / CD8 cell count ratio depicting a relation to Lyme Disease

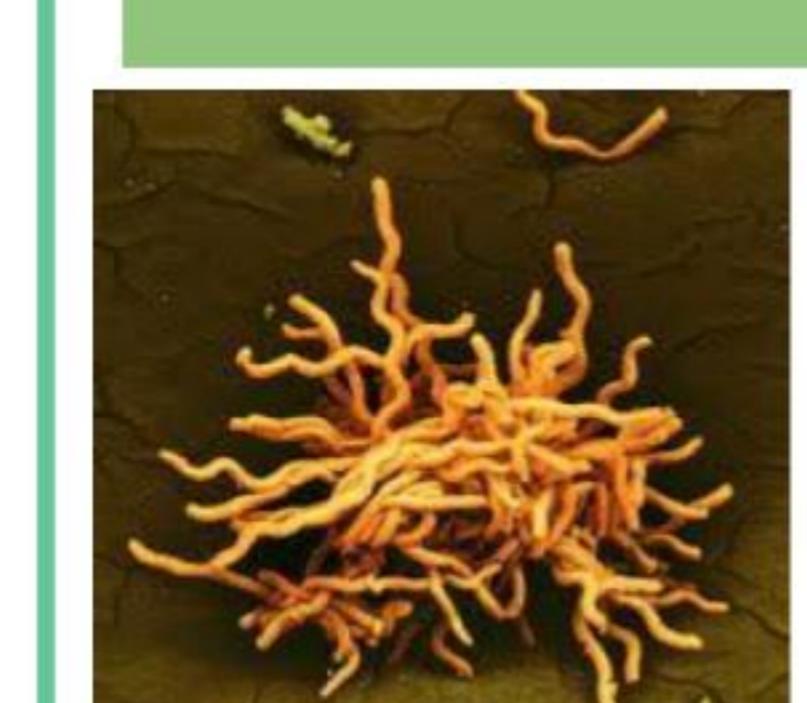
**Table 1. CD4/CD8 ratios for EBV and HHV 6 elevated Patients with Lyme Disease**

Virus	IgG/M Band	Population size (n)	Mean CD4/CD8 ratio	Two-tailed p-value	Reject Null Hypothesis
EBV	IgG	105	2.4104	0.00169	Yes
EBV	IgM	8	2.3263	0.3363	No
HHV6	IgG	103	2.5014	0.00023	Yes
HHV6	IgM	N/A	N/A	N/A	N/A

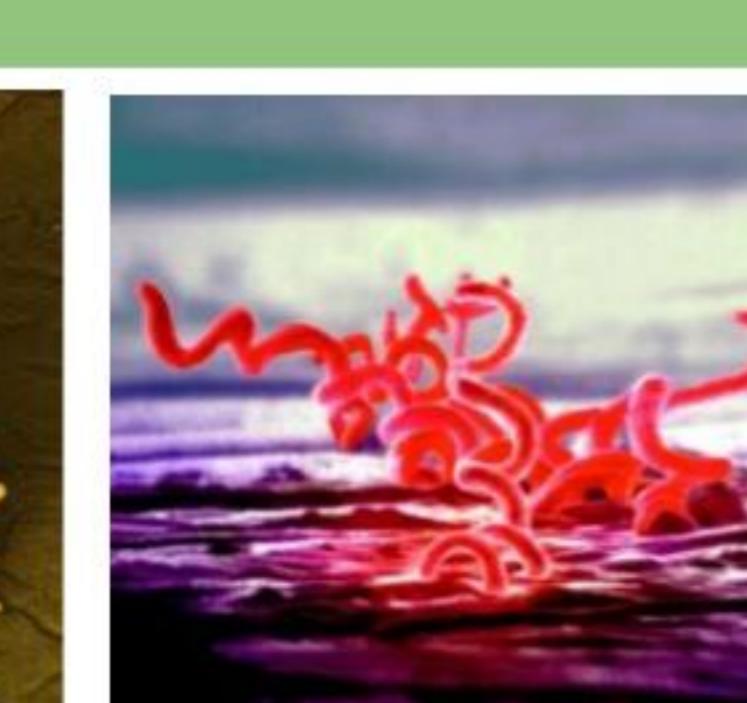
## Discussion

- The null hypothesis was rejected, thus, there is a correlation between Lyme Disease and EBV, HHV 6 virus, which proves that there is a correlation between Lyme and increased EBV and HHV 6
- Elevated CD4/CD8 ratios were seen in EBV, HHV 6 viral titers specifically when tested with the IgG band. This showcases how the immune recognizes the foreign body but is unable to act.
- On the other hand, IgM values seem to meet the null hypothesis, thus showing no significance.
- As a whole, this could lead to future studies outlining how Lyme Disease could affect the immune system

## Figure 2. Spirochetes



B. Burgdorferi



T. pallidum

## References

- Centers for Disease Control and Prevention. "Two-step Laboratory Testing Process." *Centers for Disease Control and Prevention*, 26 Mar. 2015. Web: <https://www.cdc.gov/lyme/diagnosis/testing/labtest/twostep/index.html> April 10, 2018
- Lu W, Mehraj V, Vyboh K, Cao W, Li T, Routy JP. CD4:CD8 ratio as a frontier marker for clinical outcome, immune dysfunction and viral reservoir size in virologically suppressed HIV-positive patients. *J Int AIDS Soc*. 2015;18(1):20052. Published 2015 Jun 29. doi:10.7448/IAS.18.1.20052