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Epstein-Barr virus: the cause of Multiple Sclerosis.

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Abstract

Background. Multiple sclerosis (abbreviated MS, also known as disseminated sclerosis) is a life-long, chronic and more or less unpredictable disease of the central nervous system. The exact cause of Multiple Sclerosis is still unknown.

Methods. In this publication, the study of Wandinger et al. is reanalysed using the conditio sine qua non relationship and the mathematical formula of the causal relationship c. This methods are already known since 1989. All P values are one-sided; significance was indicated by a P value of less than 0.05.

Results. Using the conditio sine qua non relationship, it could be proofed that without an infection with Epstein-Barr virus no development of Multiple Sclerosis. On the other hand, using the mathematical formula of the causal relationship c, it could be found that Epstein-Barr virus is at the same time the cause of Multiple Sclerosis.

Conclusions. Without an infection with Epstein-Barr virus no development of Multiple Sclerosis. Epstein-Barr virus is the cause of Multiple Sclerosis. A successful vaccine against Epstein-Barr virus will prevent from Multiple Sclerosis.

Key words: Causal relationship, Epstein-Barr virus, Multiple Sclerosis, Cause, Effect, Barukčić

1. Introduction

Multiple Sclerosis (abbreviated MS, also known as disseminated sclerosis) is a life-long, chronic and more or less unpredictable disease of the central nervous system. This chronic and inflammatory disease is characterized by the gradual destruction of myelin (demyelination) throughout the brain and spinal cord. In the worst cases, MS can produce partial or complete paralysis, permanent neurologic problems often persist. In the United States, about **400,000** people are suffering from MS. The prevalence of Multiple Sclerosis in the USA, the number of people with MS at a particular point in time in a particular place, is thus about approximately 1 in 700. Multiple Sclerosis is more common in women than in Men and occurs with much greater frequency in higher latitudes (above 40° latitude).

Treatments for Multiple Sclerosis include Steroids, Beta interferon, Mitoxantrone, Muscle relaxants and tranquillisers, Physical therapy and various aids such as canes, foot braces and walkers. Still, there is as yet no cure for MS.

Many different viruses have been associated with Multiple Sclerosis, Epstein-Barr virus, among others, none of them has yet been confirmed as the cause of MS. Although much is known about Multiple Sclerosis, many unanswered questions remain. The exact cause of Multiple Sclerosis still remains unknown.

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2. Methods

2.1 Patients

Wandinger et al. analysed the Sera in a group of **108 MS** patients and in **163 healthy** control subjects. The prevalence of antibodies against the Epstein–Barr virus (EBV) was determined. In addition, a polymerase chain reaction (PCR) for the detection of EBV DNA was performed. They found that antibodies against EBV were present in 100% of MS patients and in 90% of the healthy control subjects. Let us show this data in the following 2-2-table.

Epstein-Barr virus and Multiple Sclerosis.				
Wandinger, K.-P. et al. (2000). "Association between clinical disease activity and Epstein–Barr virus reactivation in MS," Neurology **55**, 178-184.		Multiple Sclerosis		
		Yes	No	
Epstein-Barr virus antibodies/ infection	Yes	108	147	255
	No	0	16	16
		108	163	271

2.1 Statistical Analysis

All statistical analyses were performed by self-programmed software. The new statistical techniques developed by Barukčić (Barukčić 1989, 2006a, 2006b; Thompson 2006) were used. The formula of the conditio sine qua non was used to detect a **conditio sine qua non relationship** like **without** A **no** B between investigated random variables.

The mathematical formula of the **causal relationship c** (Barukčić 1989, 2006a, 2006b; Thompson 2006) discovers causal relationships between experimental/non-experimental data. This formula was used to proof whether there is a significant causal relationship between Epstein-Barr virus and Multiple Sclerosis. All P values are one-sided; significance was indicated by a P value of less than 0.05.

3. Results

3. 1. Without an infection with Epstein-Barr virus no development of Multiple Sclerosis.

According to the study above, none of the EBV-uninfected patients developed Multiple Sclerosis. Let us reanalyse the data Wandinger et al. (Wandinger, 2000). Our hypothesis are:

Ho: Null-Hypothesis: p (Epstein-Barr virus ← Multiple Sclerosis) = 1.
HA: Alternative-Hypothesis: p(Epstein-Barr virus ← Multiple Sclerosis) < 1.

3.1.1 The probability of the conditio sine qua non relationship

The probability of the without an infection Epstein-Barr virus no multiple sclerosis conditio sine qua non relationship was calculated from the data above (Barukčić 2006a, pp. 236-267) as

$$p\ (\text{Epstein-Barr virus} \leftarrow \text{Multiple Sclerosis}) = 1.0.$$

3.1.2 The lower confidence bound of the conditio sine qua non relationship

The lower confidence bound of the conditio sine qua non relationship above was calculated from the data above (Barukčić 2006a, pp. 253-254) as

$$p_{lower} = 0{,}9500411.$$

The probability of the conditio sine qua non relationship

$$p(\text{Epstein-Barr virus} \leftarrow \text{Multiple Sclerosis}) = 1.0$$

is higher then

$$p_{lower} = 0{,}9500411.$$

In so far, the data above do support our Null-hypothesis:
without an infection with Epstein-Barr virus
no development of Multiple Sclerosis,

we accept the Null-hypothesis and reject the Alternative-hypothesis ($p < 0.05$).

Without
an infection with Epstein-Barr virus
no
development of Multiple Sclerosis.

3.2 Epstein-Barr virus: the cause of Multiple Sclerosis

The infection with Epstein-Barr virus could be the cause of Multiple Sclerosis too. Let us reanalyse the data of Wandinger et al. (Wandinger, 2000) using the mathematical formula of the **causal relationship c** (Barukčić 2006a) under this point of view. Our hypothesis are:

Ho: Null-Hypothesis: **c (Epstein-Barr virus $\Rightarrow$ Multiple Sclerosis) $\leq$ 0**.
or there is no causal relationship between Epstein-Barr virus and Multiple Sclerosis.

HA: Alternative-Hypothesis: **c (Epstein-Barr virus $\Rightarrow$ Multiple Sclerosis) > 0**.
or there is a causal relationship between Epstein-Barr virus and Multiple Sclerosis.

3.2.1 The calculated causal relationship $c_{calculated}$

The **causal relationship c** between an infection with Epstein-Barr virus and the development of Multiple Sclerosis was calculated according to Barukčić (Barukčić 2006a, p. 254, p. 317, p. 349) as

$$\mathbf{c = + 0{,}2038957.}$$

3.2.2 The critical value of the causal relationship $c_{critical}$

The critical value of the **causal relationship** $c_{critical}$ was calculated according to Barukčić (Barukčić 2006a, pp. 328 - 329) as

$$\mathbf{c = + 0{,}099917.}$$

3.2.3 The P value of the causal relationship c

The P value of the causal relationship c above was calculated according to Barukčić (Barukčić 2006a , pp. 325-327) as

$$\mathbf{P\ value = 0{,}00039461.}$$

3.2.3 The Power of the causal relationship c

The power of the causal relationship c above was calculated according to Barukčić (Barukčić 2006a, p. 332-335) as
$Z_{\beta} = -1{,}7116932$
power $= 1 - p (Z_{\beta} = -1{,}7116932) = + \mathbf{0{,}95652338869,}$
a very strong and highly significant result. Thus, we reject our Null-Hypothesis and accept the alternative hypothesis.

There is a highly significant causal relationship between an infection with
Epstein-Barr virus and the development of Multiple Sclerosis
(P value = 0,00039461, Power = 0,95652338869).

Epstein-Barr virus is the cause of Multiple Sclerosis.

4. Discussion

The result above is very important. **Without** an infection with Epstein-Barr virus **no** development of Multiple Sclerosis. An infection with Epstein-Barr virus is not only a conditio sine qua non of multiple sclerosis. Epstein-Barr virus is at the same time the cause of Multiple Sclerosis (p value = 0,00039461, power = 0,95652338869) too. Finally, **the cause of Multiple Sclerosis is identified.** A vaccine against Epstein-Barr virus will prevent from Multiple Sclerosis.

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