

Can Latent Toxoplasmosis lead to Alzheimer's Disease?

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Dear Editor,

Alzheimer's disease is a degenerative neurological disease that causes permanent destruction of neurons and approximately two-thirds of the cases of dementia are caused by it.^{1,2} *Toxoplasma gondii* is considered the major risk factor for the development of Alzheimer's due to causing neurodegenerative disorders in the central nervous system.³⁻⁵ Therefore, many studies linked chronic toxoplasmosis and Alzheimer's disease, the current most prevalent type of dementia. Recently, many researchers recorded that *T. gondii* is the main risk factor that promotes the pathogenesis of AD, because the presence of *T. gondii* cysts in the brain which simulates the immune system against toxoplasmosis, interferon-gamma stimulates macrophages in the brain to kill *T. gondii* through promoting an increase in nitric oxide production and degeneration of neurons that produce dopamine.

Recent research approved that long-term exposure to *T. gondii* may raise the risk of developing dementia-related (neurodegenerative) disorders including schizophrenia, migraine, bipolar disorder type I, and AD, and suggested that toxoplasmosis can modify behavior, including changes in memory and learning, and neophobia.⁶⁻⁸ Several researchers have suggested that the mechanism of cerebral toxoplasmosis can affect the astrocytes, neurons, and glial cells and might result in unusual neurotransmitter synthesis, could bring on neuro-inflammation, and could change how the host behaves.⁹ Nayeri et al.,¹⁰ approved that chronic toxoplasmosis plays an important role in the development of mental disorders such as Alzheimer's and is a strong risk factor for the development of disease. This occurs by the promotion of the host's immunological responses, inflammation of the central nervous system, and

changes in the neurotransmitter level. Additionally, toxoplasmosis elevates the activity of the dopamine-releasing enzyme tyrosine hydrolase, which is expressed by parasite genes.¹¹ Dopamine is an essential neurotransmitter in the brain that has a substantial impact on the etiology of AD. Recently a study done by Yang et al.,¹² in Taiwan, reported that *T. gondii* is considered a risk factor and enhanced the development of AD. According to several earlier researches, they found that chronic toxoplasmosis has been linked to schizophrenia, obsessive-compulsive disorder, and altered human behavior.¹³ Memory loss and cognitive decline are two additional neurodegenerative symptoms that could result from it.¹⁴ Cognitive dysfunction may be impacted by the cysts' location in the brain, the immunological response, or modifications to brain metabolism.¹⁴ On another hand number of researches have been done and declined the association between toxoplasmosis and AD, for example, a study done by Perry et al.,¹⁵ discovered that there was no difference in the serum *T. gondii* antibody titer between the AD group and control group of the latent toxoplasmosis, and Mahami-Oskouei et al.,¹⁶ also demonstrated that there were no significant relationships between toxoplasmosis and AD from a case-control study. We concluded there is a strong significant connection between toxoplasmosis and AD according to many studies, reported that there is a relation between latent toxoplasmosis and AD because toxoplasmosis can affect on brain and cause neurological degeneration. On the other hand, several studies were done and recorded there was no relation between toxoplasmosis and AD. Therefore, more controlled studies are required for innovative new treatments to prevent AD. ■

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