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**( Brain Viral Infection & Its link to memory loss )**

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## **Abstract :-**

Neurotropic viruses can cause devastating central nervous system (CNS) infections, especially in young children and the elderly.

Infections of the brain are less common than that of other organs, and depend on rare events that allow the virus to penetrate the blood brain barrier

Most systemic viruses do not enter the brain. Those that do may take advantage of rare events that include break down of the blood brain barrier, or infection of Trojan horse-like immune cells that are competent to cross the blood brain barrier, but in doing so, subsequently release viruses within the brain.

Many recent studies have proven that Viruses can cause neurological problems due to a number of mechanisms including lytic effects on brain cells (cytomegalovirus), induced apoptosis (vesicular stomatitis virus, VSV), or secondary damage due to release of glutamate, DNA, and other inducers of further brain damage.

Other viruses such as rabies do not kill neurons, but instead commandeer cellular transcriptional pathways to express viral rather than neuronal genes; this results in neurons that no longer function as neurons.

## **Introduction :**

Memory is a complex function that involves multiple steps, starting with the input of the stimulus to the brain and ending with independent memory retrieval

human memory is made up of three basic stages: sensory memory, where information is derived from touch; visual or aural; short-term memory and long-term memory. The different steps in memory retention take place throughout the brain

The prefrontal cortex, which is part of the brain's frontal lobe, is highly developed is referred to as the "coordinator" in short-term memory.

The task of consolidating short-term memories into long-term memories is performed by the hippocampus, which is located in the brain's temporal lobe.

After the memory is consolidated, it is stored in the cerebral cortex, which the Nemours Foundation states is the outermost layer of the brain made of gray matter. The memory is now independent of the hippocampus, so it can be recalled at any time.

Virus infections of the brain can lead to transient or permanent neurologic or psychiatric dysfunction in these areas leading to long term problems & loss of such mechanisms responsible for collecting , processing & recalling of these memories

In this report , I'm going to discuss some of the damage mechanisms occur by several types of common viruses explained by group studies of scientists worldwide

## **Discussion :-**

- The first study is done by Eric J. Buenz, Ph.D., a recent graduate of the molecular neuroscience program at Mayo Graduate School , Picornaviruses are the most common infectious viral agents in humans. They are a family of viruses that include rhinoviruses, which is a virus associated with the common cold; enteroviruses, a virus associated with respiratory and gastrointestinal ailments; encephalitis, inflammation of the brain; myocarditis, inflammation of heart muscle; and meningitis, A. Researchers were intrigued by the possibility of a link between picornavirus infections and memory loss .

In the study, mice were infected with Theiler's murine (mouse) encephalomyelitis virus (comparable to the human poliovirus). Researchers looked for signs of spatial memory loss in the mice. Mice that contracted the virus had difficulty learning to navigate a maze designed to test various components of spatial memory. The degree of memory impairment, which ranged from no discernable damage to complete devastation, was directly correlated to the number of dead brain cells in the hippocampus region of the mouse's brain

The degree of brain damage in humans infected with a picornavirus infection is not known, but the evidence from the mouse study suggests that picornavirus infections throughout the lifetime of an individual may chip away at the cognitive reserve, increasing the likelihood of detectable cognitive impairment as the individual ages., may, in fact, be due to accumulative loss of hippocampus function caused by repeated infection with common and widespread neurovirulent picornaviruses

In general, viruses that kill neurons in the hippocampus are not uncommon. For example infections caused by the herpes virus or human immunodeficiency virus (HIV) can lead to the loss of brain cells, but while brain damage from these viruses is based on a persistent infection, brain damage from a picornavirus infection occurs only during the acute phase of infection<sup>1</sup>.

- Another study was done in University of Miami and Columbia University in New York City conducted a study of chronic infections on 1,625 adults around age 70  
Participants completed a cognitive assessment called the Mini-Mental State Examination (MMSE), which measures attention, memory, and language skills in order to screen for dementia. Their blood samples were also tested for several common infections, including herpes simplex type 1 virus (HSV-1), which causes cold sores; herpes simplex type 2 (HSV-2), which causes genital herpes; cytomegalovirus; chlamydia pneumoniae, a common respiratory infection; and Helicobacter pylori  
Participants with a higher infectious burden were 25 percent more likely to score below average on cognitive tests. Researchers tried accounting for other factors that could have affected their cognitive function, like age, education, and drug and alcohol use, but the results still held  
The study found association between infectious burden and decline in cognitive scores over time , the link between infections and cognitive impairments was highest among several demographic groups: women, people with lower education, and people with low levels of exercise<sup>2</sup>
- Another study from Researchers at Washington University School of Medicine in St. Louis have shown that Thousands of people live with memory loss and other long-term neurological problems as a result of infection with West Nile virus, which is spread by mosquitoes  
Every year as mosquito season arrives, so does West Nile virus, causing fever in thousands of people nationwide and life-threatening brain infections  
About half the people who survive that infection – West Nile encephalitis – are left with permanent neurological deficits such as memory loss.  
These long-term neurological problems may be due to the patient's own immune system destroying parts of the neurons in the brain

Ten thousand West Nile survivors are living with long-term neurological problems such as fatigue, weakness, difficulty walking and memory loss, and the number goes up by about 1,000 every year following mosquito season

Researchers developed a mouse model of West Nile encephalitis by injecting a weakened strain of the virus directly on top of the mouse hippocampus, a region of the brain

the infected mice could not remember how to navigate the maze. But, their hippocampal neurons hadn't been killed by the virus, Instead, the researchers found that microglial cells, a kind of immune cell that lives in the brain, were clustered around the neurons at the site of infection and were highly activated

Moreover, levels of an immune protein called complement were high in the brains of mice with memory loss. and Complement tags the weak synapses to be removed, and the activated microglia destroy them

In the mice with memory loss, viral infection seemed to have sent this system into overdrive, leading to the destruction of necessary synapses, While the neurons near the activated microglia were still alive, they lacked synapses. The more synapses that were destroyed, the worse the mouse's memory problems.

West Nile survivors, however, may be unable to grow new synapses to replace the ones lost during their bouts of encephalitis, because The microglia remain activated long after the virus is cleared, and this may be preventing the synapses from recovering<sup>3</sup>

### **Conclusion :-**

Brain viral infections are less common than bacterial infections due to that most viruses cannot pass the blood brain barrier but still some viruses that can pass the barrier could cause a serious damage to the various brain areas responsible for memory consolidation and as a result permanent or transit memory loss

### **References :-**

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