Proceedings of the 2nd International Conference on Biological Engineering and Medical Science (ICBioMed 2022), Part II
DOI: 10.54254/2753-8818/4/20220577

A Summary of the Current Studies on Alzheimer's Disease

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Abstract. About five to six percent of Americans in 1999 had dementia or Alzheimer's disease (AD). Accordingly, 4 million Americans are estimated to have Alzheimer's. The load on care and the expense to society will rise as the population ages. By 2050, it is predicted that 14 million Americans will have Alzheimer's disease. Alzheimer's disease is the fourth leading cause of death in humans. Alzheimer's disease affects 5-10% of persons over the age of 65 and around 50% of those over the age of 85. Like this dangerous disease, Alzheimer's has no obvious cause and is still being studied. After 2022, after much debate in academia, the topic became murkier. This article provides background information and the latest descriptions of Alzheimer's disease.

Keyword: Alzheimer’s disease.

1. Introduction

German scientist Aloysius Alzheimer initially observed minute alterations in the brains of those suffering from Alzheimer's disease in 1906 [1]. He performed an autopsy on a woman who had become progressively confused in the years before her departure. He claimed to have seen alterations in neural knots and brain plaques. Only an autopsy may reveal these characteristics [2, 3]. Neural nodes and patches can influence how neurons function, such as interacting and sending information to the rest of the body. Alzheimer's disease is the name of the condition.

It is a neurodegenerative condition called Alzheimer's disease (AD). He's responsible for 60 to 70 percent of dementia. Patients often withdraw from society and family. The average life expectancy after a diagnosis of Alzheimer's is usually between six and eight years, and loss of physical function can lead to death.

Alzheimer's disease has no recognized etiology. Alzheimer's disease is influenced by both environmental and hereditary factors. In addition, stress, mental disorders, and head trauma are all possible causes. Protein deposition, the interlacing of nerve fibers, expansion of the brain stem, and hollow brain are not easy to detect, and the early symptoms are similar to natural aging. Because the final diagnosis of Alzheimer's requires studying brain tissue which can only be done after death. Currently, there are no drugs or supplements that can reduce the risk.

The most typical sign of Alzheimer's disease may be memory loss, particularly from recent experiences and recently learned material. The earliest signs and symptoms are progressive, subtle, and may be indicative of more than simply Alzheimer's dementia[4]. You may, for instance, lose yourself in a familiar setting, forget if a task has been finished, tell the same tale over and over, or fail to pick up new information. The patient could struggle to find the correct words to say or be unable to make mature decisions as the illness worsens. Patients can fail to identify friends or relatives, which is one of the most

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difficult parts of the illness. Hyperactivity, paranoia, sadness, and social reserve are examples of personality changes that might happen. After then, persons with Alzheimer's may become disoriented and have trouble returning home. New study, however, raises the possibility that Alzheimer's sufferers may have damage to the brain regions responsible for processing visual and spatial information. Patients may also become distracted and unable to take care of their daily physical needs. Alzheimer's disease may also have an impact on other brain regions, including the hippocampus and brain, both of which are crucial for memory. Many Alzheimer's patients passed away from other diseases including pneumonia.

2. The current situation of the Alzheimer's disease

The appearance of AD is either slow or hidden. The average life expectancy is 73 years for men and 75 years for women. Under severe external pressure, very few patients deteriorate rapidly. According to the deterioration of clinical cognitive and physical function, there are three stages: Stage 1 (dementia in those 1-3 years); Stage 2 (2-10 years, moderate dementia) Patients in stage 3 (8–12 years, severe dementia) are totally dependent, suffering from severe forgetfulness, are unable of caring for themselves on their daily basis, are incontinent, quiet, and have rigid limbs. Eventually they fall into a coma, which can lead to death from infection.

3. Possible triggers

3.1. Amyloid beta

Amyloid beta, which makes up plaques and plays an important role in Alzheimer's, has previously been thought to be a trigger for the disease. Proteins are significant molecules that regulate a number of bodily functions. Our brains naturally contain amyloid, but as we become older, too much amyloid builds up and forms plaques in the brain.[3] And block the transmission of neurons. But there is debate about whether amyloid beta can actually be extracted and whether amyloid beta is really a trigger for Alzheimer's.

3.2. Tau protein

Alzheimer's disease is also considered to be brought on by tau hyperphosphorylation. Protein concentrations in the brains of those with Alzheimer's disease are greater than those of those without the condition. In Alzheimer's patients, a tenth of the normal strength of the link between tau and the organism loses function, maintaining the tubular compound to maintain stability. Phf-tau competes with the hose to bind either regular tau or a polymer protein bound to another hose. In addition, these proteins are extracted from microtubules, leading to dissociation and disruption of the normal microtubule system, where the unusual, phosphatized tau protein accumulates in the PHF/NFT structure. Patients with Alzheimer's disease have severely damaged microtubule structures that impede normal axonal transport, leading to synaptic loss, altered neuronal function, and brain degeneration. Three different forms of tau proteins that build up in PHF have been discovered in the brains of people with cognitive impairment, along with anomalies in tau-protein in phosphoric acid solutions in water.

3.3. Neuroinflammatory reaction

Neuroinflammation is a prominent feature in the pathogenesis of AD, which is related to neuronal damage in AD patients. Microglial cells are the most key of immune cells from central nervous system, central nervous system anti-inflammatory factor and proinflammatory factor balance can adjust the activation of MG cells, under normal circumstances, the MG cells in static state, when the body has long been at proinflammatory MG environment activates cells, and anti-inflammatory environment can inhibit the MG cells for a long time. Elderly people experience a generalized chronic shortness of inflammatory response, which worsens with advancing age, developing a progressive rise in status, enhancing peripheral blood proinflammatory factor, penetrating the blood-brain barrier to enter the central nervous system, causing imbalances in the central nervous system's inflammatory response,

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shifting the system's inflammatory balance in favor of the proinflammatory direction, activating MG cells, and producing its own neural immunization [5]. In both AD patients and animal experiments, it has been found that microglia converge to SP, forming chronic inflammation and causing cell apoptosis. The apoptotic cells will induce inflammation, forming a vicious cycle. Moreover, neuroinflammation can in turn promote the aggregation of NFTs and the production of Aβ, aggravating the cognitive dysfunction of AD patients.

The brains of AD patients may undergo further alterations in addition to the augment of plaques and solid masses. The connections between nerve cells have been severed, and the corresponding brain regions for memory, including the hippopotamus and nerve cells are dying. The hippocampus is a deep structure of the brain that is responsible for short-term memory. In the later stages of the disease, the cerebral cortex, particularly the area of language and inference, is affected. As a result, most critical regions of the brain shrink.

3.4. Gut microbiota theory

There are about 10 to 100 trillion commensal microorganisms in the human body, more than 95% of which are distributed in the human gut [6]. In addition, intestinal mucosa contains a large amount of lymphoid tissue, which occupies 70% to 80% of the whole-body immune system, so it is considered as the largest and most important immune organ of the human body. Intestinal mucosal lymphoid tissue maintains a continuous close relationship with the large number of intestinal floras, which is of great significance for maintaining the homeostasis of the body's internal environment. Under normal circumstances, the human microbiota remains stable for several months or even several years. However, poor living habits and exposure to pathogens can change the gut microbiota, resulting in the occurrence of a variety of diseases. Recent research has revealed a connection between the central nervous system and the gut bacteria. The gut microbiota of AD model mice has a drastically altered distribution of microbes compared to normal animals as the illness progresses. This link between gut microbiota and the central nervous system is known graphically as the "microbe-brain-gut axis."

Intestinal flora can be through the following three ways to affect the central nervous system: First, the intestinal bacteria can produce and secrete a variety of substances that tighten the lower intestinal barrier, causing the gut microbes to enter the body more quickly, triggering a systemic inflammatory response, long-term chronic inflammation, which compromises the blood-brain barrier and causes AD; Secondly, intestinal microorganisms have the capacity to produce a wide range of small molecular metabolites (such as monoamines, amino acids, short-chain fatty acids, etc.) and transport them through the lymphatic and blood systems to the central nervous system and the entire body, thereby impacting normal physiological functions. According to previous studies, AD mice have significantly altered intestinal flora and significantly higher blood levels of phenylalanine and isoleucine, all of which cause central inflammation and AD. These changes also encourage the infiltration of peripheral immune cells into the brain and cause peripheral inflammation [7]. Finally, gut microbes can produce a series of small molecule neuroactive substances, such as serotonin, knurine, melatonin, gamma-aminobutyric acid, catecholamine, histamine, and acetylcholine, which can be directly involved in the regulation of the central nervous system.

In addition, some neurons are more susceptible than others to changes associated with Alzheimer's that can lead to binding of tau toxic proteins, while other cells resist such changes for many years or even decades. In January 2021, researchers identified the most severely infected neurons and separated them from neighboring cells, which appeared to be more resilient [8]. Sequencing using a technique known as mononuclear RNA revealed that fragile cells can be sorted by the genetic activity of neurons and produce a protein called RORB. It is not clear whether Roark himself sensitizes cells to tau. With further research, the scientists discovered that these cells accumulate proteins faster than other cells and found a way to make them more resistant to Alzheimer's, thereby slowing development.

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3.5. The genetic form of Alzheimer's disease

Most of the causes of Alzheimer's disease are unknown, but genetic and environmental factors have been identified. Alzheimer's disease mainly occurs between the ages of 60 and 65, and more than 75% of people are dispersed with no family history. A family history of Alzheimer's is present in about 25% of patients. Parents may inherit susceptible dementia genes and risk genes, as well as risk factors associated with shared conditions and family lifestyle. Early onset AD occurs between the ages of 30 and 60 and may be one of three faulty genes [9]. Mutations in one allele of three different genes produce an abnormal protein directly responsible for early family Alzheimer's disease. These genes are different from the X and Y chromosomes, which are located on different chromosomes, and are therefore known as individual chromosomes that affect men and women equally. A defective version of the gene inherited from parents may have dementia, even if the normal version of the same gene comes from the other side. The defective gene is thus described as the dominant gene. Alzheimer's disease caused by a faulty gene is known as "dominant Alzheimer's disease." If a parent has a faulty gene, each child has a 50 percent chance of inheriting and developing Alzheimer's; if both parents have copies of the mutated gene, each child has a 75 percent chance of inheriting at least one copy of the mutated gene. Parents who carry two copies of the mutation pass on the defective gene from generation to generation.

3.6. Alzheimer's caused by tau abnormalities

In addition to numerous amyloidosis deposits, intracellular nerve fibers from AD patients are associated with many cases. NFTS occur in nerve cells. After tau-related genes are modified by aberrant translation, phosphorylation and acetylation of tau are increased, and abnormal accumulation of tau is increased, which itself forms the double helix line that forms NFTS. Typically, tau protein concentrates on axons, binds to microtubules, promotes the production of new microtubules, upholds microtubule integrity, and preserves proper axonal transit. Excessive or improperly phosphated tau inhibits microtubule structure, causing problems with axonal transport and microtubule segregation, which in turn causes neuronal degeneration, degeneration, and AD.[10] In addition, the results of cell and animal experiments indicate that tau can promote or enhance the excitatory signaling signal by regulating the distribution of signaling molecules related to synaptic activity. If tau is modified in an unusual way, it can increase the concentration of abnormal iron, resulting in abnormal iron resin proteins, leading to disruption of normal neural pathways and stimulation of neurotoxicity.

4. Conclusion

Although Alzheimer's disease has been known about for a long time, we still don't completely comprehend it. The pathogenesis and therapy of Alzheimer's disease are not well understood. Alzheimer's disease continually modifies cognition as well. The early signs of Alzheimer's disease, such as dependency on others, significant memory loss, an inability to care for oneself in everyday life, incontinence, and other typical symptoms, are just briefly summarized in this paper along with some recent research and results on the condition. And there are potential causes for Alzheimer's disease, such as amyloid beta, which is frequently seen in individuals with the condition and has been linked to certain proteins in the brain. However, there is debate about whether amyloid beta is the true cause of Alzheimer's disease or not. Excessive phosphorylation of Tau protein is another factor hypothesized to contribute to Alzheimer's disease in addition to amyloid beta. Additionally, the gut microbiota and neuroinflammatory response are also considered to be potential causes of Alzheimer's disease. The true etiology of Alzheimer's disease has so remained a mystery up to this point. However, there are known genetic and environmental causes of Alzheimer's disease. While genetic Alzheimer's disease frequently develops beyond the age of 60 to 65, early-onset Alzheimer's disease affects adults between the ages of 30 and 60. Also, there are still too many gaps in our knowledge about Alzheimer's disease. As a result, this review study is just a broad overview, but it will be crucial for future studies on Alzheimer's disease. This synopsis is meant to be helpful.

DOI: 10.54254/2753-8818/4/20220577

Reference

[1] Gale SA, Acar D, Daffner KR, Am J Med 131(10), 1161-1169 (2018).
[2] Mendez MF, Archives of Medical Research 43 (8), 677–685 (2012).
[3] Breijyeh Z, Karaman R, Molecules 25 (24), 5789 (2020).
[4] Johnson, P. A.. Down Syndrome (The Gale Encyclopedia of Genetic Disorders, Gale, 2022), pp. 568-573.
[5] Knopman DS, Amieva H, Petersen RC, Chételat G, Holtzman DM, Hyman BT, Nixon RA, Jones DT, Nat Rev Dis Primers 13 (7), 33 (2021).
[6] Ganguli M, Dodge HH, Shen C, Pandav RS, DeKosky ST, Archives of Neurology 62 (5), 779–784 (2005).
[7] Knopman DS, Amieva H, Petersen RC, Nat Rev Dis Primers 7 (1), 33 (2021).
[8] Song B Y, Journal of Xi 'an University of Arts and Sciences (Natural Science Edition) 4, 77-79+92 (2020).
[9] Hoyle, Brian, and Brenda Wilmoth Lerner. Science (Gale Science Online Collection, Gale, 2021).
[10] Breijyeh Z, Karaman R, Molecules 25 (24), 5789 (2021).