



Alzheimer's Disease

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ABSTRACT

Alzheimer's disease is a brain disorder associated with memory loss, loss of speech and muscular coordination due to progressive degeneration of brain. Various reasons have been suggested for the onset of disease such as defective ApoE gene and accumulation amyloid β proteins abnormal association of tau protein etc.

Keywords: Dementia, memory loss, amyloid precursor protein, ApoE4 protein, neurofibrillary tangles.

INTRODUCTION

21th September is celebrated as world Alzheimer day. The objective behind the celebration of a day is to create awareness among the common man about the facts associated with that day. Alzheimer's disease is a type of dementia that severely effects the thinking, behaviour and ability to perform everyday task by the man suffering from the Alzheimer's disease. The disease was first identified way back in 1907 by Alzheimer but its real recognition came when the former president of united states of America Ronald Reagon was diagnosed with Alzheimer disease that led to his death in 2004. President Reagon after being diagnosed for Alzheimer, wrote the famous letter in the name of the American people which contains the quote "unfortunately as Alzheimer disease progresses, the family often bears a heavy burden"

Alzheimer disease is a fastgrowing brain disorder that get worse over time. It causes the brain to shrink and brain cells to eventually die. It is characterized by loss of neurons and synapses in cerebral cortex and subcortical region that results in gross atrophy of the affected regions Alzheimer is the most common cause of dementia in old age people. About 6.5 million people in united states age 65 years and more are supposed to suffer from this disease. Among them more than 70% of the sufferer are 75 years old or more than that. In India about one million

people suffer from Alzheimer disease every year. The risk factor of getting Alzheimer is age dependent and increases with age and at the age of 85 or more the risk increases by 1/3. The early sign of the disease includes forgetting recent events or conversations. Over time it get worse with onset of multiple symptoms such as memory loss, difficulty in thinking and reasoning, making judgment and taking decisions, planning and performing familiar task.

Memory loss

The memory loss due to Alzheimer disease leads to various changes in the person such as repeated statement and queries. The disease is not only immensely painful for the person who suffer but also very difficult for the family members because they have look after the person and bear the expenses of the treatment for a long period of time.

The progress of Alzheimer can be divided in three stages. The first stage is associated with loss of short term memory due to adverse effect on hippocampus part of the brain which is responsible for memory. With the progress in the disease ,the memory impairment gradually increases .At this stage in most cases the symptom is mistaken with the effects of ageing or stress.

Symptoms

The early stage symptoms include

- i. Agnosia – Lack of perception
- ii. Apraxia - Shrinking vocabularies

Although in early stage most of the symptoms go unnoticed, agnosia and apraxia are more prominent than memory problem.

The progressive degeneration of brain parts eventually hinders the independence of the person.

- The person becomes unable to perform daily routine works.
- Communication skills both oral and writing deteriorates further. Shrinking of vocabularies leads to speech difficulty and paraphasia i.e., inability to use correct word in sentences.
- The long term memory which was perfect in early stage becomes lost. The person fails to recognize close relatives.
- The neuropsychiatric changes appear and the patient becomes irritable, aggressive and resistible to care giving.

- Symptoms of agnosia (unable to recognize) and Anomia i.e., inability to remember name becomes more prominent.
- Motor activities become less coordinated as the disease progresses and chances for affected persons to fall down while walking increase.

The symptoms of final stage which is also called severe stage includes:

- Oral communication is reduced to simple phrase or single word which eventually leads to complete loss of speech.
- Loss of muscular mass and further deterioration of motor activities cause the patient to become bedridden and completely dependent on caretaker. He is even unable to feed himself.

Causes

The cause of Alzheimer is still not very well known. Some investigators called it genetic and other believe that it is caused by environmental factors. In about 2% patient genetic differences has been identified. Several hypotheses have been postulated to explain the cause of Alzheimer and amongst them are extracellular accumulation of abnormal amyloid beta called amyloid plaque and intracellular accumulation of abnormal tau protein forming neurofibrillary tangle are the two most accepted ones. The abnormality is associated with misfolding of these proteins.

Amyloid β is formed from cleavage of amyloid precursor protein (APP) which is coded by the gene located on chromosome 21. It is found that persons suffering from down syndrome having an additional chromosome 21(trisomy 21) show at least early sing of Alzheimer disease. Another genetic factor is presence of ApoE4 protein which is coded by ApoE gene located on chromosome 19. ApoE is associated with transportation and deposition of apolipoprotein in cell. ApoE has four allelic form and Apoe4 allele causes the synthesis of ApoE4 isoform. ApoE enhances the breakdown of amyloid beta but ApoE4 is not very effective in breaking down the amyloid beta protein. The formation of amyloid beta plaque due to presence of ApoE4 allele in heterozygous or homozygous condition disrupt the coordinated neuronal activities that ultimately leads to degeneration of neurons. ApoE allele increases the risk factor for Alzheimer disease by three times in heterozygous condition and fifteen times

in homozygous condition. Amyloid plaques mostly consists of amyloid peptides and cellular materials outside and around the neurons.

Tau (tubulin associated unit) proteins are heat stable protein coded by MAPT gene located on chromosome 17q21. These proteins are found abundantly in neurons of central nervous system (CNS). These are highly soluble proteins exist in six isoforms and associated with modulation of microtubules particularly in axon. The tau proteins stabilize microtubule by promoting tubulin assembly. The tau proteins also regulate microtubule mediated axon transport and recruitment of signal proteins. Formation of fibrillar tangles is supposed to be due to hyperphosphorylation of tau. The tau hypothesis

state that excessive or abnormal phosphorylation of tau results in conversion of soluble tau into paired helical filaments (PHF) and association of PHF results in formation of neurofibrillary tangles (NFT) which leads to neurofibril degeneration. It is found that all the six isoforms of tau are hyperphosphorylated in person suffered from Alzheimer disease (Tzioras M et al., 2019) Some studies suggested vitamin D deficiency is also one of the causes of dementia and Alzheimer's disease (Thomas et.al., 2014, Belion et.al.,2012). It is found that cerebral vitamin B5 deficiency may well cause neurodegeneration and dementia in AD, which might be preventable or even reversible in its early stages, by treatment with suitable oral doses of vitamin B5(Jingshu xu et.al.,2020).

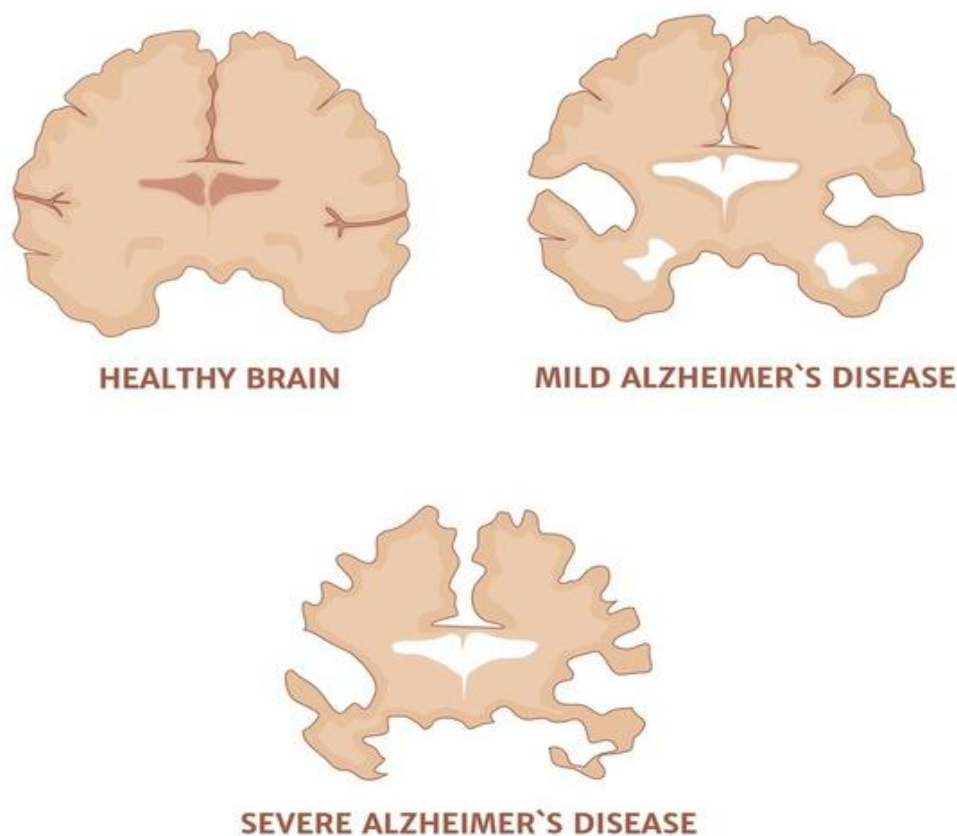


Fig. Showing changes in brain of a person suffering from Alzheimer's disease

Diagnosis

The only definite diagnostic technique for AD is autopsy which till now can not be applied on alive person. All other clinical diagnosis is associated with other findings.

Technique such as computed tomography magnetic resonance imaging (MRI) etc. are used to rule out other causes of dementia. Alzheimer's disease is usually diagnosed with the help of persons medical history, from

the statements of care giving persons and the genetic features of the affected person. It is found that more than twenty percent people having similar symptoms due to other reasons are misdiagnosed for AD.

Treatment and prevention

Till now no treatment have been developed to stop or reverse the progress of Alzheimer's disease though some may temporarily improve the symptoms. Thus most of the investigations have been focused on to prevention of onset and progress of AD.

The persons with heart ailments such as hypertension, hypercholesterolemia, depression and sleep apnea etc. have a high risk of AD. thus normalizing the blood pressure and cholesterol level may reduce the chance of AD. It is believed that sleep increases the clearance of amyloid beta or vice versa. Thus a good and sound sleep may reduce the risk factor for AD.

Smoking supposed to increase the risk of AD. Good routine life along with physical exercise may prevent the development of Alzheimer's disease. Many believe that regular reading, higher education and all those activities which require use of brain reduces the chance of development of AD.

Conflict of Interest: None of the authors have any conflicts of interest to disclose. All the authors approved the final version of the manuscript.

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