Chapter

Introductory Chapter: Alzheimer's Disease—The Most Common Cause of Dementia

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1. Introduction

Alzheimer's disease (AD) is the utmost common form of dementia, a usual term for memory defect and other cognitive impairments that seriously affect daily life [1]. This degenerative disease is accountable for 60–80% of dementia cases. AD is not a typical part of normal aging. The supreme well-known threatening factor is aging, and the mainstreams of people with AD are 65 years and older [2]. In fact, AD is not considered as a disease of adulthood. AD and other types of dementia affect a predictable 1 in 14 persons over the 65 year of age and 1 in every 6 persons over 80 years of age. But, about 1 in every 20 cases of AD affects people with in age ranging 40–65 years, which is called early-onset AD.

AD is a progressive disease that deteriorates over time, and symptoms of dementia steadily exacerbate. In its initial stages, memory defect is mild, but over a number of years in late-stage, AD patients lose the aptitude to convey a message and reply to their surroundings [3]. AD is the sixth foremost cause of death in the USA. Patients with AD may live an average of 8 years after the symptoms are visible to others, but the survival rate is higher; it can range from 4 to 20 years, based on aging and other health situations [4].

AD is still incurable, but current treatment strategies can momentarily reduce the deterioration of the symptoms and progress of the quality of life of the patients. Today, there is a universal effort to find better ways to treat the development and progression of AD. The purpose of this chapter is to give an overview of AD.

2. Alzheimer's and the brain

The brain has billions of nerve cells called neurons attached with each other to construct communication network. There are several groups of nerve performing specific jobs like thinking, learning, remembering, smelling, etc. [5].

To perform their job, like the receiver of supplies, generation of energy, construction of equipment, and disposal of waste, neurons operate like tiny factories. Brain cells also reserve, process information, and connect with other cells. In order to keep all of these running, they require a huge amount of fuel and oxygen as well as coordination.

Efforts of a lot of researchers are going on to untangle the complicated changes of the brain happened in the early stage and advancement of AD (**Figure 1**).

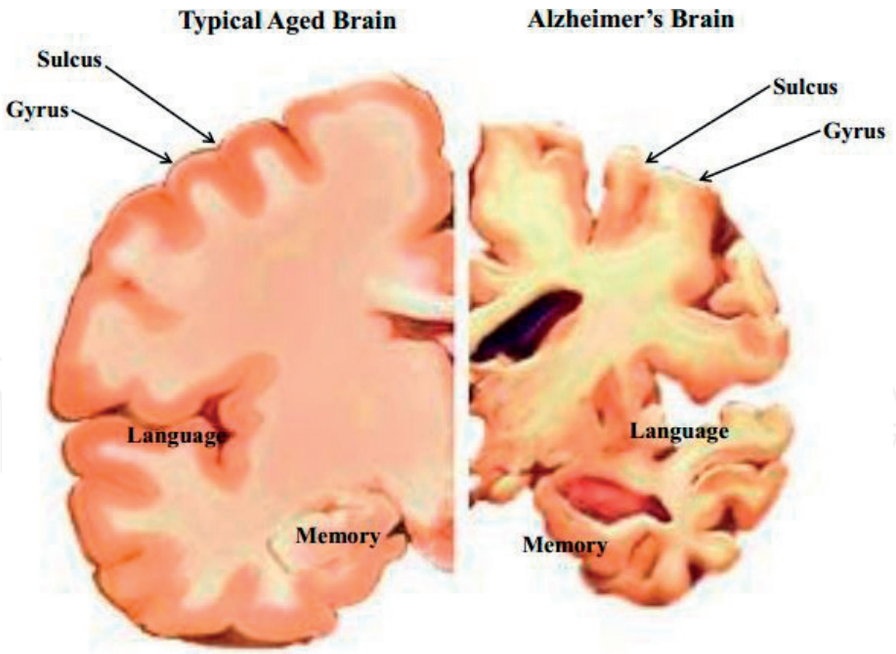

Figure 1.
The normal aged brain and the brain of an Alzheimer's patient.

It seems feasible that brain degradation starts a decade or more before memory deficit and other cognitive dysfunctions actually appear. Throughout the early stage of AD, patients do not display any symptoms; however, cytotoxic turns do appear in the brain. Senile plaques (SPs) and neurofibrillary tangles (NFTs) are formed due to abnormal deposition of proteins that result in discontinued function of neurons, failed internetwork, and ultimately neuronal death [6].

The hippocampus is the part of the brain having the vital role in generating memories and seems to be affected initially, and later, the damage spreads out to all other parts of the brain [7]. As a result, the brain starts to shrink. Moreover, significant widespread damage and shrunk in the brain tissues appear in the final stage of AD.

3. Causes of Alzheimer's disease

The main reason of AD is not completely understood till now. Approximately 70% reason for Alzheimer's is genetic [8, 9]. A number of factors are supposed to raise the risk of developing the condition such as:

- Family history
- Untreated depression
- Lifestyle-related factors linked with cardiovascular events

4. Signs and symptoms of Alzheimer's disease

With age, changes in the brain as well as rest of the body cells are obvious. Most of us in general notice such kind of changes by facing difficulties like losing the capacity of thinking and/or remembering certain things.

Difficulties in remembering newly known things and information are the most usual early feature shown in AD, because in the initial stage of Alzheimer's changes occur in the area of the brain involved in learning [10]. In advance stage of the AD, brain changes cause generation of progressively awful symptoms, including disorientation, behavior, and mood changes; deepening skepticism about events, location, and time; baseless doubts about family, friends, and professional caregivers; serious loss of memory; and difficulties in the everyday jobs like swallowing, speaking, walking, etc. [11].

There are numerous threatening signs and symptoms of AD. Every people may notice one or more of these signs in a diverse degree:

- Memory deficit that interrupts daily life
- Alterations in planning or problem solving ability
- Trouble in doing routine works at home and work
- Misperception about place and time
- Trouble in the visualization and spatial dealings
- Difficulty in speaking or writing
- Forgetting things and reducing the capacity to repeat phases
- Reduction of judgment skill
- Alteration of personality and mood
- Separation from social events or works

5. Pathological Hallmarks of Alzheimer's disease

The SPs consist primarily of amyloid β (Aβ) and neurofibrillary tangles (NFTs), consist of tau proteins are the abnormal structures considered as suspects for the damage of brain cells. Aβ is derived from the amyloid precursor protein (APP), which is cleaved by beta secretase and gamma secretase, and NFTs are the aggregates of hyperphosphorylated tau protein [12].

A lot of people develop plaques and tangles along with age, as shown by autopsy studies. Patients with Alzheimer's have the potential to spread into far more areas by plaques and tangles in a foreseeable pattern [5]. In fact, first, these pathological hallmarks appear in the area of memory before spreading to the other regions.

The impact of plaques and tangles in AD still remains unclear. Most of the researchers believe that they somehow play a complex pathogenic role in AD to block the network of brain cells and interrupts the processes required for cell survivals [13]. The destruction and death of nerve tissues are the causes of failure of the memory, personality changes, and other difficulties to carryout usual activities in everyday life and other symptoms of AD.

6. Alzheimer's and typical age-related changes

In case of most people, the sporadic decrease in memory is measured as a typical part of the aging, which is not a threatening sign of stern mental failure or the onset of dementia (**Table 1**).

Signs of Alzheimer's/dementia	Typical age-related changes
Poor judgment and decision-making	Making a bad decision once in a while
Inability to accomplish a budget	Missing a monthly payment
Losing trail of the date or the season	Forgetting which day it is and remember it later
Trouble having a conversation	Occasionally forgetting which word to use
Misplacing things and being unable to retrace steps to find them	Losing things from time to time

Table 1.
The differences between AD and typical age-related changes [14].

The memory deficits that are usual amid older adults and usually are not reflected as caution signs of dementia is presented below:

- Becoming easily blurred
- Rarely forgetting an appointment
- Entering into a room and forgetting the reason for entrance
- Unable to recover info that are on the tip of the tongue
- Worried to remember just read info or the details of a chat
- Abruptly forgetting where things of common use (such as keys) have been kept
- Fail to recall names of acquaintances or difficulty in one memory with a similar one, such as calling a grandson by his/her son's name

7. Diagnosis of Alzheimer's disease

The person with age group older than 80 years if diagnosed with AD can survive at least 3–4 years, whereas younger peoples can stay alive usually about more than 10 years [15].

Various methodologies and tools are deployed by the physician to identify the actual problem such as the possible AD or probable AD.

To diagnose AD, usually physicians may:

- Ask the patient and the family member or close contacts about the health status, past medical history, capability to perform daily works, and alteration in behavior and personality
- Conduct tests of memory, attention, language, problem-solving, and counting ability
- Conduct other tests like blood and urine tests, to find other likely reasons for the problem
- Perform the scans of the brain like computed tomography, positron emission tomography, magnetic resonance imaging, or other tests to detect the promising causes for symptoms

These tests are effective to identify how the person's memory and other cognitive functions are altering over time. However, AD can be certainly diagnosed only after the death of the patient, by relating the clinical events with the autopsy of the brain.

If a person has memory problems, they must consult a physician related to their problems so as to facilitate the physician to diagnose whether it is AD or any other issues such as Parkinson's disease, stroke, sarcoma, adverse effects of medicines, or a non-Alzheimer's. Few of these diseases are curable and conceivably revocable.

If the disease is diagnosed in its early phase, it may be treatable and very helpful for future plans such as economic and legislative matters, becoming habituated to living measures and developing the buttress networks.

Furthermore, the participation of patients in clinical trials is also one of the advantages of early diagnosis because it makes newer researches and treatments for AD.

8. Treatment of Alzheimer's disease

Due to the complexity of AD, its treatment by only one drug or other medication is not possible. Therefore, the pivotal strategy is to help the patient to maintain intellectual function and behavior as well as mitigate the specific concerns like reduction of memory deficits [7]. Newer therapies are expected to be establish by researchers to target the peculiar genetic, molecular and cellular mechanism which can stop the intrinsic genesis of the disease.

Psychological treatments like cognitive stimulation therapy are also helpful to improve memory, language ability as well as problem resolving talents.

9. Prevention of Alzheimer's disease

The exact reason for the pathogenesis of AD is still anonymous [16]. But researchers put their efforts to minimize hazards or postponement of the onset of dementia, and suggested the following that can reduce the chance of dementia:

- Stopping smoking
- Reducing alcohol consumption habit
- Eating a balanced diet as well as maintaining weight
- Staying physically and mentally fit and active

Not only AD, these events have other health aids, such as reducing the risk of numerous diseases especially cardiovascular disorders and improving the overall health status.

10. Research and progress

Nowadays, studies are focusing to detect the exact etiology of plaques deposition, tangles formation, and associated with other biological landscapes of AD [7]. The development and progress of Aβ and NFTs in the living brain, as well as the change in brain anatomy and activity, can be observed with the help of existing brain scan techniques. With the help of the results obtained by studying the alterations that take place in the brain along with body fluids, researchers evaluate the

initial steps involved in the disease progress prior to the appearances of Alzheimer's symptoms that give information about the root cause of AD as well as also facilitates its diagnosis.

The utmost enigma of AD is why it mostly attacks older is still a great obscure [7]. Research on the typical aging of the brain is making this question transparent. Researchers are learning how age-linked variations in the brain may damage neurons and contribute to AD. The alterations caused due to atrophy (i.e., shrinking) in some area of the brain, infections, release of free radicals as well as the mitochondrial defect (some deformities in the powerhouse of the cell causes unnecessary breakdown of energy molecules and results in the loss of energy). These alterations in old age people enlighten the reason why adults are susceptible to AD.

11. Conclusion

Current studies are working to elucidate copious aspects of AD and dementia. About 90% of what we know about AD has been discovered in the last 20 years. The greatest auspicious progress in AD research is how it affects the brain. There is hope that this superior understanding of the pathogenic mechanism will lead to better treatment strategy with minor adverse/side effects. At present numerous latent approaches are under study worldwide.

Conflict of interest

The authors proclaim that they have no competing interests.

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