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A REVIEW on Alzheimer's Disease; Current Concepts and Emerging Therapeutic Approaches

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Abstract

Alzheimer's disease (AD) is a progressive neurodegenerative disorder and the most common cause of dementia in older adults. It gradually impairs memory, thinking, language, reasoning and the ability to perform everyday activities. The disease is associated with complex changes in the brain, including accumulation of beta-amyloid plaques, abnormal tau protein tangles, synaptic dysfunction, inflammation and neuronal loss. Age is the strongest known risk factor, while genetic, cardiovascular, metabolic, lifestyle and environmental factors may also influence risk. Diagnosis combines clinical history, cognitive assessment, laboratory investigations, brain imaging and, when appropriate, biomarker testing. Management includes symptomatic medicines, disease-modifying therapies for selected patients, management of behavioral and psychological symptoms, non-pharmacological interventions and caregiver support. Research continues to investigate earlier diagnosis, precision medicine and new therapeutic approaches.

Keywords: Alzheimer's disease; dementia; amyloid-beta; tau; neurodegenerative; cognitive decline; cholinesterase inhibitors; memantine; biomarkers; disease-modifying therapy.

1. Introduction;

Alzheimer's disease is a chronic, progressive brain disorder that causes deterioration in memory and other cognitive functions. It eventually interferes with independent daily living. According to the National Institute on Aging, Alzheimer's is the most common form of dementia among older adults. Dementia itself is an umbrella term for several diseases and conditions affecting memory, cognition and behavior; the World Health Organization identifies dementia as a major public-health priority.

2. Epidemiology and Public Health Importance;

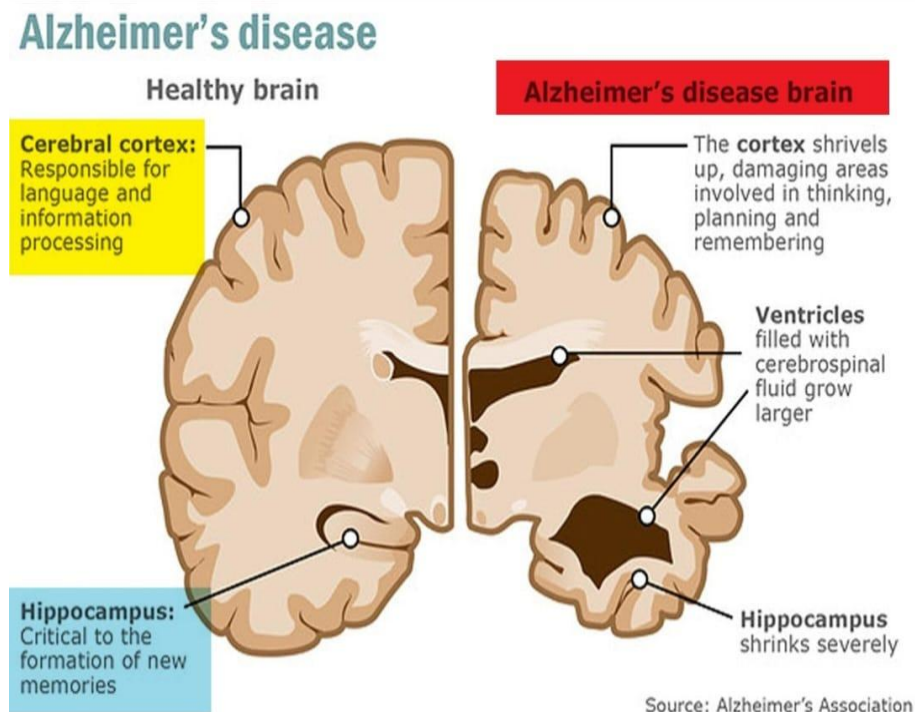
Dementia affects millions of people worldwide and creates substantial needs for health care, long-term support and caregiver assistance. WHO reported that 57 million people were living with dementia globally in 2021 and that nearly 10 million new cases occur each year. Because Alzheimer's is the most common form of dementia, its growing burden is closely linked to population ageing. The disease affects not only patients but also families and caregivers through physical, psychological, social and economic consequences.

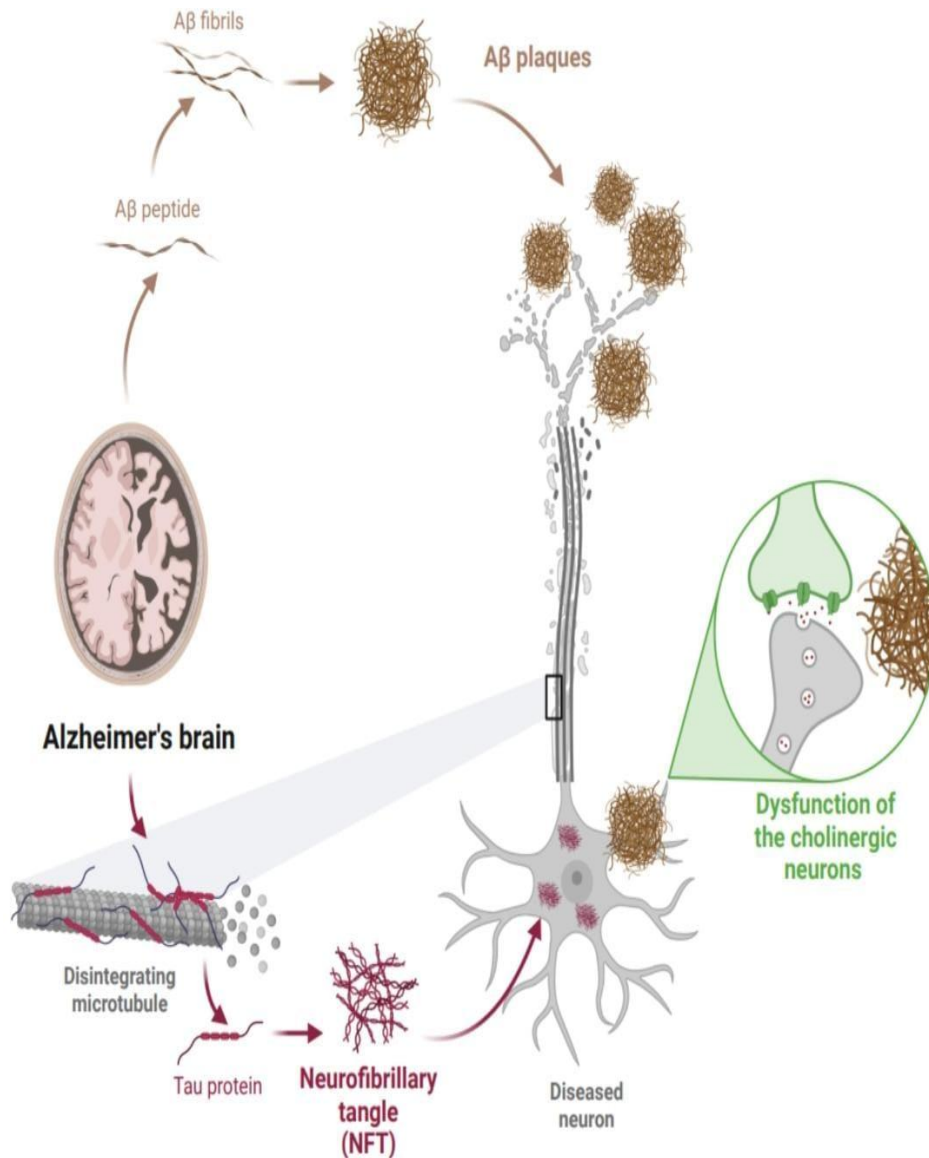
3. Etiology and Risk Factors;

The exact cause of Alzheimer's disease in most people is not fully understood. Current evidence supports a combination of age-related brain changes, genetic susceptibility, health conditions, lifestyle and environmental factors. Age is the strongest known risk factor. Family history can increase risk, while the APOE ϵ 4 genetic variant is associated with increased risk but does not determine with certainty whether an individual will develop the disease. Rare inherited variants in APP, PSEN1 and PSEN2 can cause familial early-onset Alzheimer's. Other factors associated with increased risk include cardiovascular disease, high blood pressure, diabetes, obesity, physical inactivity, smoking, harmful alcohol use, poor sleep, hearing loss, social isolation and traumatic brain injury.

4. Pathophysiology;

Alzheimer's disease involves progressive damage to neurons and their connections. Two major pathological hallmarks are beta-amyloid plaques and neurofibrillary tangles containing abnormal tau protein. Amyloid accumulation and abnormal tau processing are associated with synaptic dysfunction,





neuronal injury and eventual neuronal loss. Neuroinflammation, oxidative stress, vascular abnormalities and impaired cellular energy processes may also contribute. Brain regions involved in memory are affected early, followed by areas involved in language, reasoning and behavior. These changes can begin years before prominent symptoms become apparent.

5. Clinical Features and Symptoms;

Early symptoms commonly include short-term memory problems, repeating questions, misplacing objects, difficulty finding words, reduced ability to plan or solve problems, and difficulty completing familiar tasks. As disease progresses, people may experience disorientation, impaired judgment, language difficulties, changes in mood or behavior and increasing dependence on others. In advanced disease, communication and mobility may become severely impaired and basic activities of daily living can require extensive assistance.

6. Diagnosis;

Diagnosis begins with a detailed history from the patient and an informant, followed by physical and neurological examination and cognitive testing. Clinicians may use blood and other laboratory tests to identify alternative or contributing causes. Brain imaging such as MRI, CT or PET may support diagnosis or exclude other conditions. Biomarkers of amyloid and tau in cerebrospinal fluid, PET imaging and selected blood-based tests can provide biological evidence of Alzheimer's pathology. Genetic testing is not routinely used to predict Alzheimer's in the general population, although it may be considered in selected cases of early-onset disease with strong family history.

7. Pharmacological Management;

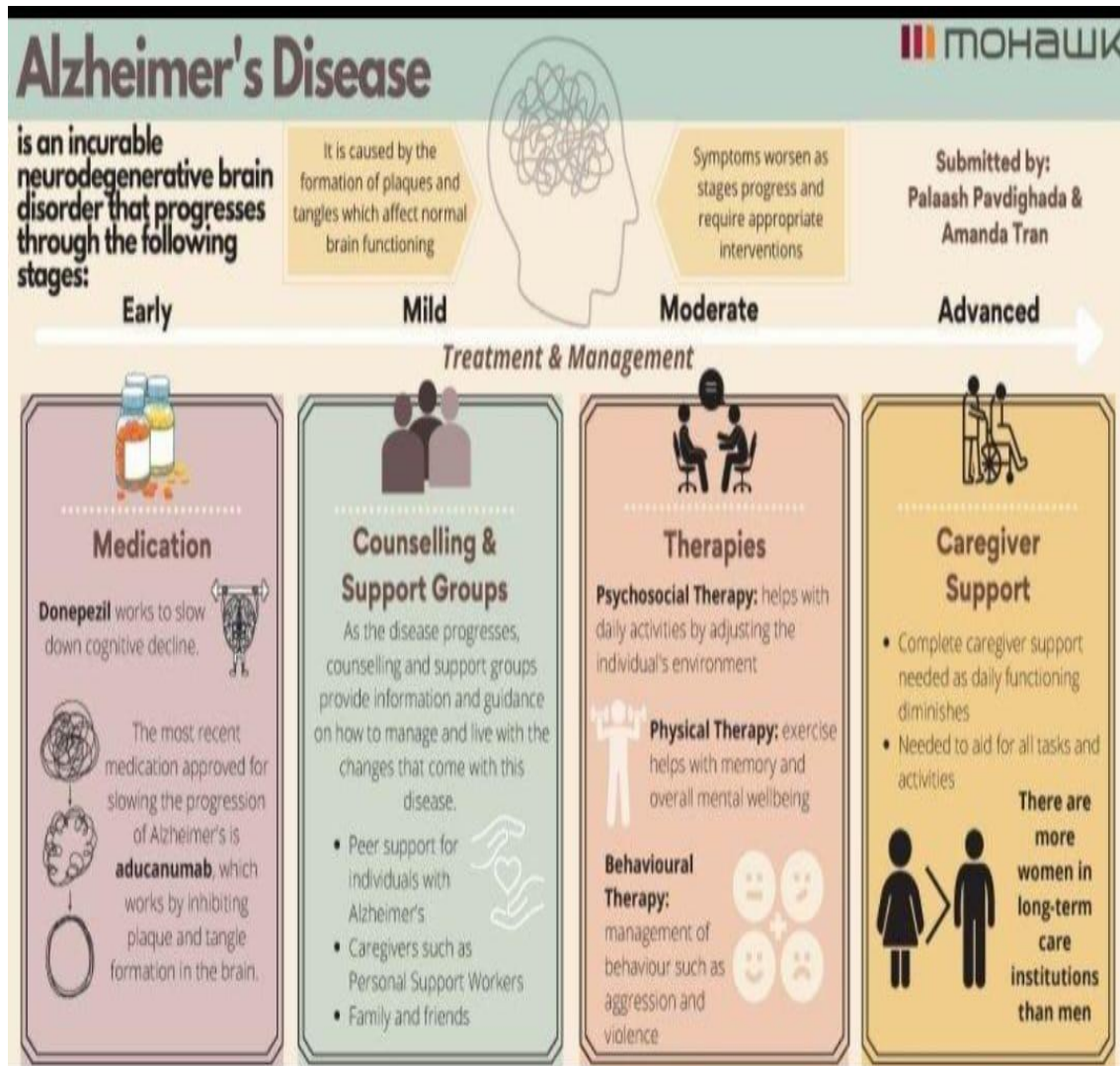
Symptomatic treatment may include cholinesterase inhibitors such as donepezil, rivastigmine and galantamine, which can provide cognitive or functional benefit for some people with Alzheimer's disease. Memantine, an NMDA-receptor antagonist, may be used in moderate to severe disease and can be used in combination with a cholinesterase inhibitor. Treatment decisions depend on disease stage, comorbidities, adverse-effect risk and patient preferences. Disease-modifying anti-amyloid therapies are an evolving area of treatment and are intended for selected patients with appropriate evidence of amyloid pathology; their use requires specialist assessment and monitoring because of potentially serious adverse effects.

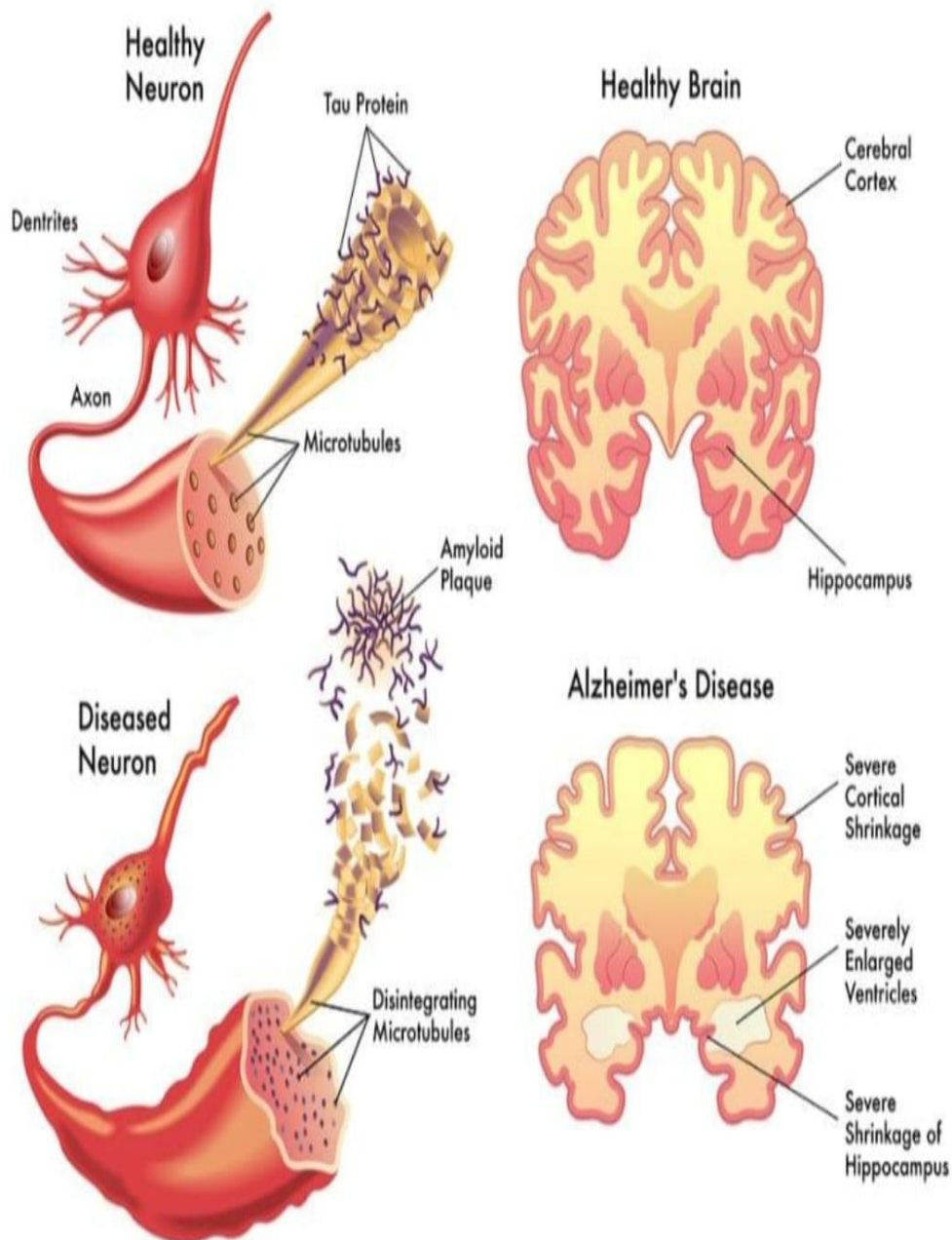
8. Non-Pharmacological Management;

Non-pharmacological care is an important part of comprehensive management. Regular physical activity, cognitive stimulation, structured daily routines, social engagement, adequate sleep and a healthy diet may support overall health and quality of life. Environmental modifications can improve safety and reduce confusion. Occupational and physical therapy may help maintain function. Caregiver education, respite support and psycho social interventions are important because caregivers often carry a substantial proportion of the long-term care burden.

9. Role of the Pharmacist;

Pharmacists can contribute to Alzheimer's care by reviewing medication lists, identifying potentially inappropriate medicines and drug interactions, supporting adherence and counseling patients and caregivers. They can monitor adverse effects and help coordinate the safe use of cognitive medicines and other medicines prescribed for comorbid conditions. Pharmacists can also reinforce non-drug measures, explain administration instructions and encourage appropriate follow-up with the treating health-care team.





10.Prevention and Risk Reduction;

No single intervention is proven to prevent all cases of Alzheimer's disease. However, management of modifiable health and lifestyle factors may support brain and cardiovascular health and may reduce the risk of cognitive decline. Evidence-based approaches include regular physical activity, a balanced diet, control of blood pressure and other vascular risk factors, avoiding tobacco, limiting harmful alcohol use, maintaining social engagement, addressing hearing problems and obtaining adequate sleep. WHO's 2026 guideline

update emphasizes a life-course approach to reducing dementia risk through healthy behaviors, management of health conditions and attention to environmental risk factors.

11. Emerging Research and Future Perspectives;

Research is progressing in biomarkers, blood-based testing, disease-modifying therapies, prevention strategies, genetics, digital cognitive assessment and precision medicine. Better identification of amyloid and tau pathology may allow treatment to be targeted more accurately. Researchers are also investigating Neuroinflammation, vascular mechanisms, synaptic health and other biological pathways. Future advances may combine earlier detection with individualized treatment and stronger caregiver and community support.

12. Conclusion;

Alzheimer's disease is a progressive neurodegenerative disorder that produces substantial cognitive, functional and social consequences. Its development is influenced by age, genetic susceptibility and a range of health and lifestyle factors. Amyloid plaques, tau pathology, Neuroinflammation, synaptic dysfunction and neuronal loss are important components of its biology. Early and accurate assessment can help patients and families plan care and consider appropriate treatment. Pharmacological therapy, non-pharmacological interventions, caregiver support and management of modifiable risk factors all have roles in comprehensive care. Continued research is essential to improve early diagnosis, treatment and prevention

Declaration of Conflicting Interests

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