

Alzheimer's disease early diagnosis and emerging therapeutic approaches.

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Abstract

Alzheimer's disease (AD) is a progressive neurodegenerative disorder and the leading cause of dementia worldwide. The disease gradually impairs memory, cognitive abilities, and daily functioning, significantly affecting the quality of life of patients and their families. Due to the increasing aging population, Alzheimer's disease has become a major public health challenge. Early diagnosis and the development of innovative therapeutic strategies are essential for slowing disease progression and improving patient outcomes. This paper discusses current approaches to early detection and examines emerging therapeutic methods that offer new perspectives for the management of Alzheimer's disease.

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Keywords: alzheimer's disease, dementia, neurodegenerative disorder, early diagnosis, biomarkers, cognitive decline, amyloid-beta plaques.

Alzheimer's disease is characterized by the accumulation of amyloid-beta plaques and tau protein tangles in the brain, leading to neuronal dysfunction and cell death. Symptoms often develop gradually, beginning with mild memory impairment and progressing to severe cognitive decline. Although the exact cause of the disease remains unclear, genetic, environmental, and lifestyle factors are believed to contribute to its development. Early identification of Alzheimer's disease is critical because pathological changes in the brain may begin many years before clinical

symptoms become evident. Timely diagnosis provides opportunities for early intervention, better disease management, and improved planning for patients and caregivers.

Biomarker research has also become an important area in early diagnosis. Scientists have identified specific proteins in cerebrospinal fluid and blood that may indicate the presence of Alzheimer's-related pathology. Blood-based biomarkers are particularly promising because they offer a less invasive and more accessible method for screening large populations. In addition, digital cognitive assessment tools and artificial intelligence technologies are increasingly being used to analyze speech patterns, memory performance, and behavioral changes. These innovative approaches may facilitate earlier and more accurate detection of cognitive decline. Traditional treatments for Alzheimer's disease primarily focus on symptom management rather than disease modification. However, recent research has led to the development of therapies targeting the underlying biological mechanisms of the disease. One promising area involves anti-amyloid therapies designed to reduce the accumulation of amyloid-beta plaques in the brain. Several monoclonal antibodies have demonstrated the ability to slow cognitive decline in certain patient populations. Although these treatments are not a cure, they represent a significant advancement in Alzheimer's research. Another emerging strategy focuses on tau-targeted therapies. Since abnormal tau protein accumulation is closely linked to neuronal damage, researchers are developing medications aimed at preventing tau aggregation and spread throughout the brain. Gene therapy, stem cell research, and neuroprotective agents are also being explored as potential treatment options. Furthermore, non-pharmacological interventions such as cognitive training, physical exercise, healthy nutrition, and social engagement have

shown positive effects on cognitive health and may complement medical treatments.

Conclusion

Alzheimer's disease remains one of the most significant neurological disorders of the modern era. Advances in early diagnostic techniques and emerging therapeutic approaches provide hope for better disease management and improved patient outcomes. While a definitive cure has not yet been discovered, ongoing scientific progress continues to expand understanding of the disease and offers promising directions for future treatment and prevention.

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