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Alzheimer's Disease Frontiers: Nanotherapeutics, Gut Microbiota, and Future Directions: A Systematic Review

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Key Points

Question:
How does gut microbiota affect Alzheimer's disease (AD)?
Can nanotherapeutics improve AD treatment?
What are future directions for AD therapies?

Findings:
Global AD prevalence is rising, with genetic factors like APOE ε4 playing a major role.
Gut microbiota dysregulation is linked to AD and may offer diagnostic and treatment potential.
Nanotechnology (e.g., nanoliposomes, exosomes) shows promise in enhancing drug delivery.

Meaning:
Innovative approaches like nanotechnology and microbiota-based therapies are crucial to address the limitations of current AD treatments.

Abstract

Importance:
Alzheimer's disease (AD) is a progressive neurodegenerative disease with no cure, causing apathy, mood and neuropsychiatric issues, and cognitive impairment.

Objective:
This study focuses on understanding its pathophysiology and discovering new therapeutics. It also discusses the development of nanotherapeutic techniques, which incorporate nanomaterials that pass across the blood-brain barrier and function as therapeutic mechanisms.

Evidence Review:
A systematic search of PubMed and google scholar for studies such as randomized control trials, reviews and systematic reviews published in the past 5 years. Key words used are AD, gut microbiota, nanotechnology in AD were used.

Findings:
The global dementia prevalence is increasing, with heritable factors influencing AD risk by 60-80%. The prevalence of Alzheimer's will double in Europe and triple in other countries by 2050. Gut microbiota dysregulation is linked to AD pathogenesis, and correcting gut microbiota eubiosis may be a diagnostic tool. Novel biomarkers, pharmacological methods, stem cell-based treatment, nanotechnology, and lifestyle-based preventative studies are being investigated for AD treatment. The APOE ε4 allele is a significant genetic risk factor for sporadic AD, and various treatment methods have proven effective in mouse models. Advancements in gene therapy, immunotherapy, peptidomimetics, metal chelators, and probiotics are also being explored. Nanoliposomes and exosomes are being explored as innovative approaches.

Conclusions and Relevance:
Nanotechnology advancements are transforming drug delivery systems, targeting multiple therapeutic moieties and improving bioavailability and penetration across the central nervous system. Current therapies struggle to produce good results or stop disease progression. Gut microbiome changes have been linked to neurodegeneration, opening new microbiota-based treatment alternatives. More study is needed to investigate these therapies and other techniques like stem cell therapy and nanotechnology. The FDA has only authorized aducanumab since 2003, emphasizing the need for new pharmaceutical techniques to combat Alzheimer's disease.

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