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ALZHEIMER: LATEST MEDICATION AND TREATMENT METHODS

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ABSTRACT

Alzheimer's disease (AD) is a progressive neurodegenerative disorder that primarily affects older adults, leading to significant memory and cognitive impairments. Despite extensive research, current treatment options for AD remain limited, primarily focusing on symptom management and slowing disease progression rather than offering a cure. Medications, such as cholinesterase inhibitors (donepezil, rivastigmine, galantamine) and glutamate regulators (memantine), are commonly used to manage symptoms. Non-pharmacological interventions, including cognitive stimulation therapy, physical exercise, and caregiver support programs, play a crucial role in enhancing the quality of life for patients. Emerging therapeutic approaches, such as immunotherapy targeting amyloid plaques, gene therapy, and stem cell therapies, are being explored but remain in the early stages of development. While these options may offer hope in the future, there is an urgent need for novel disease-modifying treatments that address the underlying pathology of AD, such as amyloid-beta plaques and tau tangles. This review highlights the current limitations of AD treatment and the promising new approaches that may lead to more effective therapies in the future.

KEYWORDS: Alzheimer's disease, neurodegenerative, cholinesterase inhibitors, glutamate regulators, cognitive stimulation, emerging therapies.

INTRODUCTION

Alzheimer's disease is a progressive neurodegenerative disease that primarily affects older adults, leading to severe impairment of memory and cognitive function. Despite extensive research efforts, there are currently limited treatment options available for Alzheimer's disease.

These options mainly focus on managing the symptoms and slowing down the progression of the disease rather than providing a cure. Some of the commonly used treatment options for Alzheimer's disease include medications such as cholinesterase inhibitors (donepezil, rivastigmine, galantamine) and glutamate regulators (memantine). In addition to medication, non-pharmacological approaches are also used in the treatment (Ain, S., 2022, Pandey, S., 2025) of Alzheimer's disease (Pandey, S., 2025). These may include cognitive stimulation therapy, physical exercise, and caregiver support programs. Other potential treatment approaches for Alzheimer's disease include: immunotherapy, which aims to target and remove amyloid plaques in the brain; gene therapy, which seeks to correct genetic mutations associated with Alzheimer's disease; and stem cell therapy, which involves the transplantation of healthy cells to replace damaged ones in the brain. Overall, the current treatment options for Alzheimer's disease are limited and primarily focus on managing symptoms and slowing down progression (Pandey, S., 2025).

While there are currently limited treatment options available for Alzheimer's disease, they primarily focus on managing symptoms and slowing down the progression of the disease . Some potential treatment approaches for Alzheimer's disease include medication like cholinesterase inhibitors and glutamate regulators, non-pharmacological interventions such as cognitive stimulation therapy and physical exercise, and emerging therapies like immunotherapy, gene therapy, and stem cell therapy. In summary, the treatment options for Alzheimer's disease are currently limited and mainly focus on managing symptoms and slowing down the progression of the disease (Pandey, S., 2025).

In summary, current treatment options for Alzheimer's disease are limited and primarily focus on managing symptoms and slowing down the progression of the disease. Some potential treatment approaches include medications like cholinesterase inhibitors and glutamate regulators, non-pharmacological interventions such as cognitive stimulation therapy and physical exercise, and emerging therapies like immunotherapy, gene therapy, and stem cell therapy. Non-pharmacological interventions such as cognitive stimulation therapy, physical exercise, and caregiver support programs. In addition to medication, non-pharmacological approaches are also used in the treatment of Alzheimer's disease. In addition to medication, non-pharmacological approaches are also used in the treatment (Dhama, P. K., 2022, Kumar, V., 2020) of Alzheimer's disease.

This includes cognitive stimulation therapy, physical exercise, and caregiver support programs. These approaches can help manage symptoms, improve cognitive function, and enhance overall quality of life for individuals with Alzheimer's disease. In addition to medication and non-pharmacological approaches, there are also ongoing research efforts to develop disease-modifying anti-Alzheimer's drugs that could slow or reverse the progression of the disease by targeting underlying pathology such as the formation of amyloid-beta plaques and tau tangles. There is an urgent need for new therapeutic (Verma, H. K., 2021, Ain, S., 2021) options for Alzheimer's disease, as current treatment options are limited to managing symptoms and slowing down disease progression.

In summary, current treatment options for Alzheimer's disease are limited and primarily focus on managing symptoms and slowing down the progression of the disease (Ain, S., 2021, (National Library of Medicine, 2025). However, there are various approaches being explored, including medication (such as cholinesterase inhibitors and glutamate regulators), non-pharmacological interventions.

TREATMENT

The Alzheimer's current treatments for Alzheimer's disease primarily focus on managing symptoms and slowing down the progression of the disease. There is no cure for Alzheimer's disease, but there are medications available that can temporarily improve symptoms and cognitive function.

In addition to medication, non-pharmacological approaches are also used in the treatment of Alzheimer's disease.

The Treatments are

MEDICINE DRUG

Cholinesterase Enzyme

Cholinesterase inhibitors are a class of drugs normally utilized in the treatment of Alzheimer's sickness. These medications work by expanding the levels of specific synapses, explicitly acetylcholine, in the cerebrum. Acetylcholine is a substance courier that assumes a critical part in memory, thinking, and by and large mental capability. Cholinesterase inhibitors help to dial back the movement of Alzheimer's and reduce a portion of the related mental and social side effects.

Here is an itemized note on cholinesterase inhibitors

The Cholinesterase Inhibitors

Donepezil (Aricept): This is one of the most regularly recommended cholinesterase inhibitors. It is accessible in various qualities and is generally required one time per day.

Rivastigmine (Exelon): This medicine is accessible in both oral and fix structures. The fix gives a consistent arrival of the medication over the course of the day.

Galantamine (Razadyne): Galantamine is accessible in different details, including tablets and broadened discharge containers.

MECHANISM OF ACTION

Cholinesterase inhibitors work by obstructing the activity of a compound called acetylcholinesterase. This compound typically separates acetylcholine, lessening its levels in the mind. By hindering acetylcholinesterase, these medications increment the accessibility of acetylcholine, which can upgrade mental capability.

Benefits

Worked on Mental Capability: Cholinesterase inhibitors can assist people with Alzheimer's keep up with or briefly work on their mental capacities, including memory, thinking, and critical thinking.

Side effect the board: These medications can likewise lessen a portion of the social and mental side effects of Alzheimer's, like fomentation and fantasies.

RESTRICTIONS

Brief Impacts: Cholinesterase inhibitors don't fix Alzheimer's illness, and their belongings will quite often be unobtrusive and impermanent. They might dial back the movement of side effects however don't prevent the infection from progressing.

Aftereffects: Normal incidental effects might incorporate sickness, spewing, looseness of the bowels, and loss of hunger. A few people may likewise encounter rest unsettling influences, muscle squeezes, or expanded pulse.

NMDA Receptor Antagonist

A class of medications known as NMDA (N-Methyl-D-Aspartate) receptor miscreants is used to treat neurological disorders, including Alzheimer's disease. Memantine is one often used

NMDA receptor irritant for Alzheimer's disease. Here's a brief overview of memantine, covering its mechanism of action, advantages, and potential side effects.

MEMANTINE'S MECHANISM OF ACTION INVOLVES

1. Preventing the brain's NMDA receptors from absurdly authorising certain behaviours.
2. Glutamate transmission locks NMDA receptors, a brain connection that is expected to play a critical role in memory and learning.
3. An overstimulation of these receptors can cause damage to nerve cells in Alzheimer's disease. Memantine addresses this by preventing the potentially harmful avalanche of calcium ions from entering nerve cells.

ADVANTAGES

1. **Mental Capacity:** Memantine is utilised to slow down the deterioration of mental capacity in Alzheimer's sufferers. To some extent, it might aid in regular working, thinking, and memory creation.
2. **Direct Aftereffects:** It can also aid in controlling the mental and social side effects, such as anger and agitation, which are frequently observed in Alzheimer's patients.
3. **Mix Treatment:** For updated fascinating easing, memantine is occasionally accepted in blend in with cholinesterase inhibitors (e.g., donepezil).

AUXILIARY EFFECTS

1. **Ordinary Optional effects:** These include instability, headaches, disarray, and obstruction.
2. **More unexpected Optional effects:** A few patients may have effects that interfere with sleep, fomentation, and nightmares. Finding any startling coincidental effects for a clinical benefits provider is fundamental.
3. **Safety:** its common knowledge that memantine is safe to use when assisted. However, just like any medicine, it may interact with other prescriptions, so it's important to tell your clinical benefits provider about all of the medications you use.

THERAPY

Monoclonal Antibodies

Alzheimer's disease is treated with monoclonal antibodies (mAbs), which are chosen for their specificity, potency, convenience of administration, and long-lasting effects. These antibodies target substances that are essential to the onset and course of the disease, such as tau or amyloid beta. Because they may be injected, people who have trouble taking other medications will find them easier to use. Clinical trials have also demonstrated the safety and efficacy of mAbs; one example is aducanumab, which the FDA licenced for the treatment of early Alzheimer's disease.

METHOD OF ACTION

Proteins made in laboratories called monoclonal antibodies (MAbs) are made to recognise and attach to certain molecules. Their primary method of action in AD is the removal of tau tangles and amyloid-beta (Aβ) plaques, which are the two pathological lesions that are characteristic of the illness.

Aβ Plaque Removal: By binding to Aβ peptides, MAbs can stop them from aggregating into plaques and encourage immune cells to break them down or remove them.

Tau Tangle Dissolution: By interfering with the aberrant aggregation of tau protein, monoclonal antibodies (MAbs) can dissolve tau tangles and lessen neuronal damage.

MAB TYPES USED IN AD THERAPY

Several mAb subtypes are being researched to treat AD:

1. **Anti-Aβ MAbs:** By either inhibiting the production of Aβ plaques or facilitating their removal, these mAbs specifically target Aβ plaques.
2. **Anti-tau MAbs:** These mAbs target the tau protein in an effort to break up any existing tau tangles and stop it from aggregating.
3. **Dual-targeting monoclonal antibodies (mAbs):** These mAbs bind to tau and Aβ at the same time, perhaps having a synergistic impact on the removal of both kinds of degenerative lesions.

Present Applications and Prospective Views

The effectiveness and safety of various mAbs in the treatment of AD are still being studied, despite the fact that these treatments have showed promise in clinical studies. The FDA recently granted fast clearance for the anti-Aβ mAb aducanumab; nevertheless, further research is necessary to address concerns regarding its safety and long-term effectiveness.

The following are potential future study areas for mAb treatment in AD

1. **Creating more potent and targeted monoclonal antibodies (mAbs):** By focusing on certain Aβ and tau conformations or alterations, therapeutic potential may be increased.
2. **Improving mAb delivery to the brain:** New delivery methods are being investigated in an effort to ensure adequate mAb penetration into the brain, which continues to be a difficulty.
3. **Finding biomarkers for patient selection:** Treatment results may be enhanced by determining which individuals are most likely to benefit from monoclonal antibodies (mAbs).
4. **Combining mAb therapy with other methods:** There may be synergistic advantages when mAbs are used in conjunction with other therapeutic techniques such tau-targeting medicines or anti-inflammatory medications.

As prospective AD disease-modifying therapies, MAbs show promise in terms of potentially reversing or delaying the course of the disease. To overcome obstacles and achieve the full therapeutic potential of mAbs in the treatment of AD, research and development on this front must continue.

STEM CELL TTHERAPY

Stem cell therapy can deliver therapeutic agents to the brain, modulate the immune system, and replace lost or damaged neurons. Even though it is still in its infancy, stem cell therapy has the power to completely alter the way we handle this incurable illness. Alzheimer's patients receive neural stem cell transplants to restore missing neurons and enhance cognitive performance. While gene therapy uses mesenchymal stem cells to deliver new genes to protect neurons from damage or promote the growth of new neurons, mesenchymal stem cells also modulate the immune system and reduce inflammation.

Principles of Action

Neurogenesis: Stem cells can develop into new neurons in the brain to replace ones that have been lost or damaged. For people with Alzheimer's disease to regain cognitive function, this neurogenesis process is essential.

1. **Neuroprotection:** Neurotrophic factors, which support the survival and expansion of neurons, can be released by stem cells. These elements may also aid in shielding neurons from additional harm brought on by Alzheimer's (Liu, X.-Y., 2020).

2. **Immunomodulation:** The ability to control the immune system is possessed by stem cells. This is relevant to Alzheimer's because the condition is exacerbated by persistent inflammation.
3. **Angiogenesis:** By encouraging the growth of new blood vessels, stem cells can enhance the brain's blood supply and nutritional uptake. This may contribute to the survival and proper operation of neurons (Qin, C., 2022).

DIFFERENT TYPES OF STEM CELLS

Neural stem cells, or NSCs, are cells that may develop into different kinds of brain tissue, such as neurons, astrocytes, and oligodendrocytes. These cells are obtained from the brain.

Mesenchymal stem cells (MSCs): MSCs can be isolated from umbilical cord blood, adipose tissue, or bone marrow. While they can develop into many other cell types, including neurons, their main contribution to Alzheimer's disease is believed to come from immunomodulation and neuroprotection.

ADMINISTRATIVE PATHS

Intracranial Injection: By injecting stem cells straight into the brain, Alzheimer's disease-affected regions can be specifically targeted for delivery.

Intravenous Injection: Another method for delivering stem cells into the circulation and enabling their migration to the brain and other organs is via injection.

Clinical studies: A number of clinical studies are being conducted to assess the safety and effectiveness of stem cell therapy in the treatment of Alzheimer's disease. Promising first outcomes have been seen, as certain research works have demonstrated enhancements in cognitive abilities and memory among those receiving stem cell treatment (Liu, X.-Y., 2020, Qin, C., 2022).

Obstacles and Prospective Paths

Standardisation of Stem Cell treatment: To guarantee consistency and repeatability of results across various trials, stem cell treatment techniques must be standardised.

GENE THERAPY

Treatment for Alzheimer's disease may benefit from gene therapy due to its potential for targeted administration, long-term effects, and disease-modifying ability. It can generate the

enzymes that break down amyloid beta, shield neurons from harm, and encourage neurogenesis. Gene therapy has the potential to completely change the way Alzheimer's disease is treated, and clinical trials are looking well. In addition, it is a one-time treatment with long-lasting results that only need one dose. Compared to existing therapies, which call for daily medication, this is a huge advantage (Saad, J. F., 2023, Nilsson, P., 2010).

Method of Action

The goal of gene therapy is to modify the degenerative processes associated with AD or fix underlying genetic abnormalities by introducing therapeutic genes into the patient's cells. This may be accomplished by introducing the genetic material into the target cells via a variety of vectors, including plasmids, viruses, and nanoparticles (Shaikh, A., 2024, Saad, J. F., 2023).

Different Gene Therapy Methods for AD

1. **Gene Replacement Therapy:** This method seeks to substitute functioning copies of damaged or absent genes. For example, substituting a normal APOE4 allele for the mutant apolipoprotein E (APOE) gene, a significant genetic risk factor for AD, may lower the likelihood of getting AD.
2. **Gene Suppressor Therapy:** This strategy seeks to mute or suppress the expression of genes implicated in the pathophysiology of AD. One potential strategy to slow down the course of AD is to silence the production of beta-secretase, an enzyme involved in the creation of amyloid plaques (Saad, J. F., 2023).
3. **Gene Transfer Therapy:** is to increase neuronal survival and function by introducing genes that encode neurotrophic factors or other therapeutic proteins into the brain. For example, gene delivery for brain-derived neurotrophic factor (BDNF) or nerve growth factor (NGF) may shield neurons from harm and enhance cognitive performance (Shaikh, A., 2024, Saad, J. F., 2023, Nilsson, P., 2010).

NON-PHARMACOLOGICAL

Non-pharmacological approaches for Alzheimer's disease treatment include cognitive stimulation therapy, physical exercise, and caregiver support programs.

Other non-drug therapies that have shown some promise in improving symptoms and quality of life for individuals with Alzheimer's disease include music therapy, art therapy, and pet therapy. Other non-drug therapies that have shown some promise in improving symptoms

and quality of life for individuals with Alzheimer's disease include music therapy, art therapy, and aromatherapy. In addition to medication and non-pharmacological approaches, research is also being conducted on potential disease-modifying treatments for Alzheimer's disease (Wang, S., 2025, National Library of Medicine, 2025).

Living with Alzheimer's symptoms can be made simpler in a number of ways that are straightforward. While not all of these will be beneficial to everyone, they consist of:

1. Reminding the person of dates, appointments, and events by using a calendar, diary, or calendar clock.
2. Labelling cabinets to indicate what's within.
3. Using a tablet or smartphone to make reminders for chores or appointments.
4. Using rhymes and pictures in the mind to help recall new information.
5. Making use of technology, such as voice-activated virtual assistants (Wang, S., 2025, National Library of Medicine, 2025).

FUTURE DIRECTIONS FOR ALZHEIMER'S DISEASE TREATMENT

Include ongoing research efforts to develop disease-modifying drugs that can target the underlying pathology of Alzheimer's disease, such as the formation of amyloid-beta plaques and tau tangles. Additionally, there is a focus on early diagnosis and intervention to improve outcomes for individuals with Alzheimer's disease.

Some potential future treatments for Alzheimer's disease include disease-modifying drugs that can target the underlying pathology of the disease, such as amyloid-beta plaques and tau tangles.

Additionally, there is ongoing research into various approaches and interventions for Alzheimer's disease treatment. Some potential future treatments for Alzheimer's disease include disease-modifying drugs that can target the underlying pathology of the disease, such as amyloid-beta plaques and tau tangles. Additionally, there is ongoing research into the role of lifestyle changes, such as diet and exercise, in managing and potentially reducing the risk of developing Alzheimer's.

DISCUSSION

The role of lifestyle changes in Alzheimer's disease treatment cannot be underestimated. In addition to medication and non-pharmacological therapies, lifestyle changes such as

maintaining a healthy diet, engaging in regular physical exercise, getting enough sleep , and engaging in social activities have been shown to have a positive impact on Alzheimer's disease treatment.

Alzheimer's disease (AD) presents a significant challenge to the medical and scientific community due to its complex pathology and the absence of curative treatments. Current therapeutic strategies are cantered on alleviating symptoms and delaying cognitive decline, primarily through pharmacological agents such as cholinesterase inhibitors and glutamate regulators. These medications offer only modest benefits and are often accompanied by side effects, which may limit long-term use. Non-pharmacological interventions, such as cognitive stimulation, physical activity, and caregiver support, provide additional relief by improving patients' quality of life and reducing caregiver burden.

Emerging approaches like immunotherapy, gene therapy, and stem cell therapy represent hopeful directions, as they aim to address the root causes of AD rather than just managing its symptoms. However, these treatments are still in experimental phases and require further clinical validation. In particular, therapies targeting amyloid-beta plaques and tau tangles show promise but have yielded mixed results in trials, indicating the need for deeper understanding of disease mechanisms.

Furthermore, the heterogeneity of AD progression among individuals complicates treatment response and underscores the need for personalized medicine approaches. Continued research into biomarkers, early diagnosis, and combined treatment modalities is essential for improving patient outcomes.

CONCLUSION

Despite decades of research, Alzheimer's disease remains an incurable neurodegenerative disorder with limited treatment options. Existing therapies are primarily symptomatic, and while they offer temporary relief, they do not halt or reverse disease progression. Non-pharmacological methods complement drug therapy but are also insufficient as standalone treatments. Innovative strategies like immunotherapy, gene editing, and stem cell therapy offer potential but remain in developmental stages. A multidisciplinary approach that combines pharmacological, non-pharmacological, and emerging therapeutic interventions, along with early diagnosis and personalized treatment plans, may hold the key to more effective management of AD in the future. There is a critical need for sustained research

efforts to develop disease-modifying treatments that can significantly improve the lives of those affected by Alzheimer's disease.

REFERENCES

1. Ain, S., Mishra, G., Kumar, B., Ain, Q., Garg, R. K., "Antidiabetic potential of developed solid lipid nanoparticles loaded with quercetin: in-vitro and in-silico studies", Annals of Phytomedicine, 2022; 11(2): 1–11.
2. Pandey, S., Kumar, V., Ain, S., Ain, Q., Kumar, B., Ruhela, N., Bhuvnesh, "Alzheimer's disease: An overview", International Journal of Research in Pharmacy and Allied Sciences, 2025; 4(2): 13–32. https://doi.org/10.71431/IJRPAS.2025.4202.
3. Pandey, S., Kumar, V., Ain, S., Ain, Q., Bhuvnesh, Ruhela, N., Nagar, C., Kumar, B., "Impact of heavy metals on respiratory disease", International Journal of Research in Pharmacy and Allied Sciences, 2025; 4(3): 1–12. https://doi.org/10.71431/IJRPAS.2025.4301.
4. Dhama, P. K., Ain, S., Kumar, B., Ain, Q., "Development and evaluation of topical ointment formulation containing gallic acid as an active pharmaceutical ingredient against bacterial infection and oxidative damage", Annals of Phytomedicine, 2022; 11(11): 439–449.
5. Kumar, V., Ain, S., Kumar, B., Ain, Q., "Optimization & evaluation of topical gel containing solid-lipid nanoparticle loaded with luliconazole and its antifungal activity", International Journal of Pharmaceutical Research, 2020; 12(2): 2901–2912.
6. Verma, H. K., Kumar, V., Ain, S., Kumar, B., Ain, Q., "Optimization and evaluation of developed topical ointment formulation containing cefadroxil and its antibacterial activity", International Journal of Pharmaceutical Research, 2021; 13(2): 3086–3096.
7. Ain, S., Ain, Q., Chaturvedi, S., Kumar, B., "Comparative assessment of groundwater quality in different areas of Delhi NCR (Ghaziabad, Noida) and East UP (Varanasi)", International Journal of Pharmacognosy and Phytochemical Research, 2021; 8(1): 58–64.
8. Ain, S., Ain, Q., Pandey, S., Tyagi, V., Vats, Y., Ruhela, N., Kumar, B., "Assessment of ground water quality in different areas of Uttar Pradesh and Haryana", Cuestiones de Fisioterapia, 2025; 54(2): 3557–3575.
9. Wang, S., Xu, H., Liu, G., Chen, L., "Non-pharmacological treatment of Alzheimer's disease: an update", Frontiers in Aging Neuroscience, 2025; 17: Article 1527242. https://doi.org/10.3389/fnagi.2025.1527242.

10. National Library of Medicine, "Alzheimer's disease: Learn more – Non-drug interventions for Alzheimer's disease", National Library of Medicine, 2025. Retrieved from https://www.nlm.nih.gov.
11. Saad, J. F., Saad, F. A., "Gene therapy for Alzheimer and Parkinson diseases", Current Gene Therapy, 2023; 23(3): 163–169. https://doi.org/10.2174/1566523223666230419101023.
12. Nilsson, P., Iwata, N., Muramatsu, S., Tjernberg, L. O., Winblad, B., Saido, T. C., "Gene therapy in Alzheimer's disease – potential for disease modification", Journal of Cellular and Molecular Medicine, 2010; 14(4): 741–757. https://doi.org/10.1111/j.1582-4934.2010.01038.x.
13. Shaikh, A., Ahmad, F., Teoh, S. L., Kumar, J., Yahaya, M. F., "Neurotrophic factor alpha 1 gene therapy in Alzheimer's disease: scope and advancements", Frontiers in Molecular Neuroscience, 2025; 18: Article 1518868. https://doi.org/10.3389/fnmol.2025.1518868.
14. Liu, X.-Y., Yang, L.-P., Zhao, L., "Stem cell therapy for Alzheimer's disease", World Journal of Stem Cells, 2020; 12(8): 787–802. https://doi.org/10.4252/wjsc.v12.i8.787.
15. Qin, C., Wang, K., Zhang, L., Bai, L., "Stem cell therapy for Alzheimer's disease: an overview of experimental models and reality", Animal Model and Experimental Medicine, 2022; 5(1): 15–26. https://doi.org/10.1002/ame2.12207.