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Mesenchymal Stem Cell Therapy for Amyotrophic Lateral Sclerosis

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Introduction

Amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig disease, is a fatal neurodegenerative disease affecting motor neurons in the brain and spinal cord. Progressive muscle weakness, atrophy, and spasticity characterize the condition, which eventually leads to paralysis and respiratory failure. There is currently no cure for ALS, and the standard of care is supportive, with riluzole being the only approved medication that has been shown to slightly slow disease progression [(1)]. However, the use of mesenchymal stem cells (MSCs) in the treatment of ALS is a new area of research in regenerative medicine. MSCs are multipotent stem cells that have the ability to differentiate into a variety of cell types, including neurons, and have immunomodulatory and anti-inflammatory properties, making them an appealing therapy for neurodegenerative diseases such as ALS [(2)]. This review examines the safety and efficacy of MSC therapy for ALS in four randomized controlled trials. The trials involved administering MSCs via various routes, including intrathecal and intravenous, and assessing outcomes such as survival, disease progression, and quality of life. The findings of these trials shed light on the potential of MSC therapy as a novel approach to treating ALS.

Methods

PRISMA 2020 guidelines used., We identified studies by searching through the database PubMed. The following string of search terms were used to identify peer-reviewed articles in each database: ("mesenchymal stem cells" OR "MSCs") AND ("clinical trial" OR "human trial" OR "human study") AND ("amyotrophic lateral sclerosis" OR "Lou Gehrig's disease"). The individual references were divided into themes.

13 articles used after full text-appraisal from 2014-2023

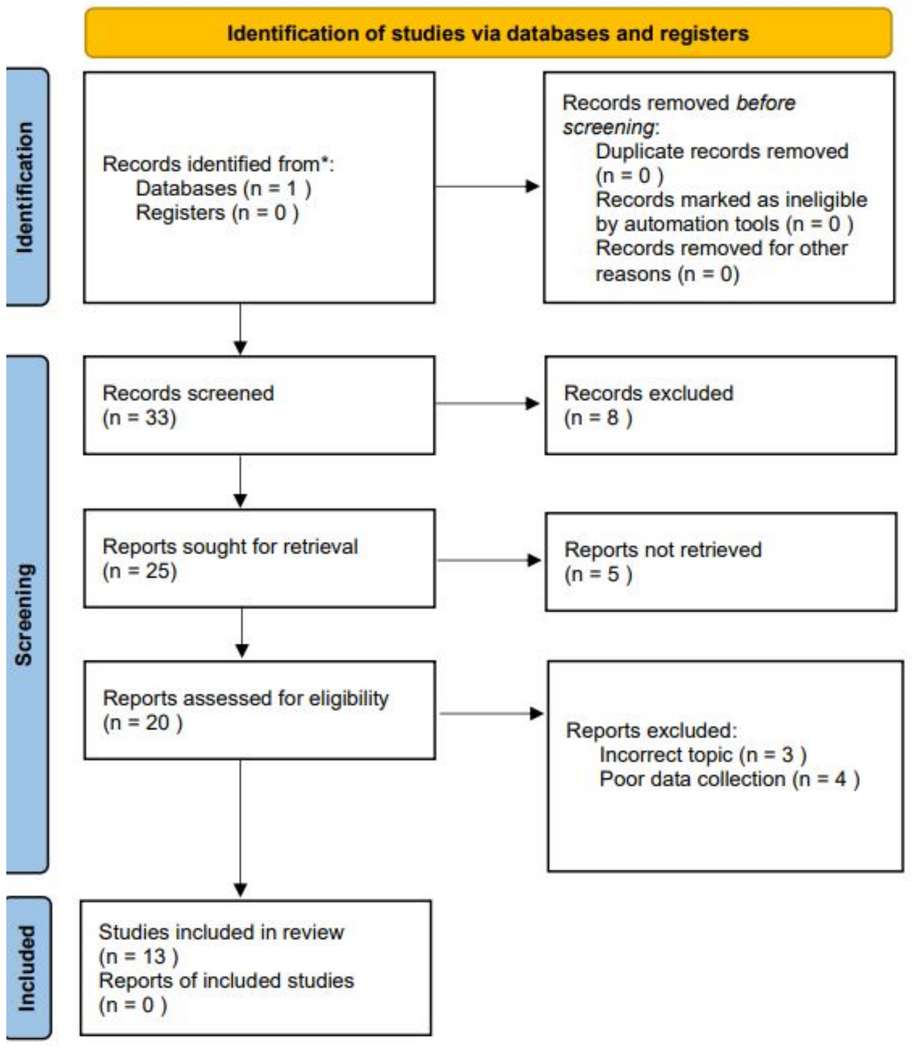

Figure 1: PRISMA Flow Sheet

Results

The four studies' findings suggest that mesenchymal stem cell (MSC) therapy for amyotrophic lateral sclerosis (ALS) is generally safe and well-tolerated. Three of the studies found a favorable risk-benefit ratio, and none of the studies found any serious adverse drug reactions. The studies yielded conflicting results in terms of efficacy. Two studies found that MSC therapy slowed disease progression in ALS patients with an inherently rapid course, while another found a significant improvement in the slope of progression of ALSFRS-R in 13 of 19 patients who received repeated intrathecal injections of autologous MSCs. However, at 28 weeks, one phase 3 study did not meet its primary endpoint of clinical response criteria.

Discussion

Amyotrophic lateral sclerosis (ALS) is a devastating neurodegenerative disease characterized by progressive muscle weakness, atrophy, and spasticity. The exact cause of the disease is still unknown, and there is currently no effective treatment for ALS. Mesenchymal stem cells (MSCs) have emerged as a promising therapeutic option for ALS due to their ability to modulate the immune system, secrete neuroprotective factors, and promote tissue repair. Several studies have investigated the potential of MSCs as a therapy for ALS. In a study published in 2018, intravenous infusion of allogeneic adipose-derived MSCs in ALS patients was found to be safe and well-tolerated, with no significant adverse events reported [(10)]. Another study published in 2019 showed that transplantation of human umbilical cord-derived MSCs into the spinal cord of ALS mice led to a significant improvement in motor function and increased survival rates [(11)]. In addition to their regenerative properties, MSCs have been shown to have immunomodulatory effects that may be beneficial in ALS. A study published in 2020 found that MSCs were able to inhibit the proliferation and activation of T cells, leading to a decrease in neuroinflammation and motor neuron degeneration in an ALS mouse model [(12)]. Another study published in 2021 demonstrated that co-culture of MSCs with ALS patient-derived astrocytes led to a reduction in astrocyte-mediated toxicity and an improvement in motor neuron survival [(13)]. While the results of these studies are promising, there are still challenges to be overcome in the development of MSC-based therapies for ALS. These include issues related to the optimal timing, dosage, and delivery route of MSCs.

Conclusion

In conclusion, while mesenchymal stem cell therapy for ALS shows promise in terms of safety, the treatment efficacy remains unknown. More research is needed to fully understand the potential benefits of MSC therapy and to determine the best treatment strategy for ALS patients.

References