

STEM CELL TRANSPLANTATION IN BIPOLAR DISORDER: EXPLORING REGENERATIVE TREATMENT APPROACHES

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Introduction: Bipolar disorder (BD) is a chronic neuropsychiatric condition affecting over 1% of the global population, characterized by alternating episodes of mania and depression. Traditional pharmacological treatments, such as lithium, valproate, and lamotrigine, remain the cornerstone of BD management; however, many patients experience treatment resistance and long-term adverse effects. With emerging advances in regenerative medicine, cell-based therapies, including stem cell transplantation, are being explored as potential interventions for neuropsychiatric disorders, offering a new direction in BD treatment.

Materials and Methods: Recent studies using induced pluripotent stem cells (iPSCs) derived from BD patients have enabled the creation of neural organoids that replicate disease-specific molecular and structural abnormalities. Functional and transcriptomic analyses have highlighted neuroinflammatory dysregulation, particularly involving interleukin-6 (IL-6), as well as alterations in neuronal plasticity pathways, including Wnt/ β -catenin signaling. Additionally, research into microRNA expression patterns suggests potential biomarkers for predicting lithium responsiveness. Experimental approaches have also investigated the potential of mesenchymal stem cells (MSCs) and exosome-based therapies in modulating neuroinflammation and promoting neuronal regeneration.

Results: Preclinical studies indicate that stem cell transplantation may enhance neuroplasticity, restore synaptic function, and regulate immune responses, potentially targeting the underlying pathophysiological mechanisms of BD. Preliminary findings suggest that MSCs and neural progenitor cells exert neuroprotective effects through paracrine signaling, anti-inflammatory properties, and trophic support. Additionally, exosome-based therapies derived from stem cells have shown promise in delivering neurotrophic factors and modulating gene expression, opening avenues for personalized, cell-based interventions in BD.

Conclusion: The transition from conventional pharmacotherapy to regenerative medicine represents a paradigm shift in BD treatment. While pharmacological interventions remain essential, stem cell-based therapies offer the potential for long-term neuroprotection and disease modification. Further clinical trials are needed to establish the safety, efficacy, and optimal administration protocols for stem cell transplantation in BD. As research advances, integrating regenerative medicine with existing psychiatric treatments may lead to more effective, personalized therapeutic strategies for patients with BD.

Keywords: Bipolar disorder, stem cell therapy, regenerative medicine, neuroinflammation, mesenchymal stem cells, exosome therapy, neuronal plasticity.