

Pathophysiology of Anxiety and the Function of Different Stem Cell Types

Justin Ejike*

Department of Psychology, University of Mental Health, Canada

Abstract

Major depressive disorder (MDD), colloquially known as depression, is a debilitating condition that affects an estimated 3.8% of the world's population. MDD is distinguished from normal mood swings and short-lived emotional responses by subtle gray and white matter alterations in the frontal, hippocampal, temporal, thalamus, striatum, and amygdala. When occurring at moderate or severe intensity, it can be detrimental to a person's overall health. When the illness reaches its peak, it can lead to suicidal or suicidal thoughts. Antidepressants treat clinical depression and work by modulating levels of serotonin, norepinephrine, and dopamine neurotransmitters in the brain. Patients with MDD respond positively to antidepressants, but 10–30% fail to recover or have a partial response, leading to decreased quality of life, suicidal ideation, self-harm, and relapse. Recent studies have shown that mesenchymal stem cells and iPSCs may play a role in alleviating depression by generating more neurons with increased cortical connectivity. This narrative review describes the plausible role of different stem cell types in treating and understanding the pathophysiology of depression.

Keywords: Depression; Stem cells; Molecular pathways; Neurogenesis; Cytokine hypothesis

Introduction

Major depression (MDD) is considered the most common mental disorder and is characterized by disability, bad mood, decreased interest in daily activities, guilt and loss of pleasure, according to the World Health Organization (WHO). and , is one of the leading causes of poor concentration and bad moods. Changes in self-esteem, sleep disturbances, and appetite are some of his symptoms of MDD [1]. These problems can become chronic or recurrent and can significantly impair the ability to carry out daily activities. At worst, depression can lead to suicidal thoughts. Depression is associated with an increased risk of other serious diseases such as cardiovascular disease, stroke, Alzheimer's disease, epilepsy, diabetes and cancer. Depressive symptoms are more common in the elderly due to age-related physical and cognitive impairment, socioeconomic disadvantage, and other factors. Treatment-resistant depression (TRD) can be triggered by continuous exposure to environmental stressors during development [2].

Almost all antidepressants work similarly and treat severe MDD for life. However, antidepressant therapy has many side effects, including sedation, headache, hypotension, insomnia, weight gain, dyspepsia, agitation, dry mouth, diarrhea, and sexual dysfunction. This often leads to poor patient compliance, recurrence of depressive symptoms, and an increased risk of suicide [3].

Stem cells have the potential to support tissue regeneration as they can self-renew and differentiate into many other cell types. This narrative review examines the role of different stem cell types in treating, understanding, and managing depression [4].

Neurochemistry of depression

Dysregulation of norepinephrine (NE), serotonin (5-hydroxytryptamine, 5HT), and dopamine (DA) is associated with pathological changes seen in depression. According to the monoamine hypothesis of depression, NE, 5HT, and DA act simultaneously to regulate emotion and mood. Dysregulation of these three monoamines with subaverage extracellular 5HT levels is observed in depressed mood. Lower concentrations of monoamines and metabolites in urine, blood, and cerebrospinal fluid (CSF) were reported in depressed patients compared with age-matched controls [5].

NE, the major neurotransmitter of the sympathetic nervous system, is produced in the locus coeruleus (LC) and can send projections throughout the CNS. Depression research began by focusing on the noradrenergic system and introducing the 'motor deactivation' hypothesis. Defects in the noradrenergic system of LC have been observed in depressed patients and victims of suicidal behavior compared to healthy subjects. In addition, several genetic mutations in norepinephrine transporters (NETs) are very likely associated with psychiatric disorders. Neurons projecting heterogeneously from the LC were found to be able to differentially regulate fear and learning, and an imbalance in the activation of these neuronal groups has been associated with post-traumatic stress disorder (PTSD) and depression in rats. Related to The possible existence of DA, another monoamine neurotransmitter known to play a key role in motivation, concentration, reward, psychomotor speed, and emotional response was highlighted. Notably, altered DA function is also associated with depression-related fatigue symptoms [6].

Depression as a neurodegenerative disease

Neurodegenerative diseases are diseases in which cells in the central nervous system stop functioning or die. Most neurodegenerative diseases are incurable and often worsen over time. Patients suffering from depression have been shown to have reduced right upper temporal lobe, left lower temporal lobe, and orbital cortex thickness compared to healthy subjects. Structural changes in the temporal lobe and prefrontal cortex have also been reported in people with depression and anxiety. Atrophy observed in the prefrontal and temporal cortices may represent a typical pattern of cortical and subcortical changes. One of the best-studied structures of the limbic system, the hippocampus

*Corresponding author: Justin Ejike, Department of Psychology, University of Mental Health, Canada, E-mail: ejikese@edu.ca

Received: 01-Mar-2022, Manuscript No: nctj-23-91225; **Editor assigned:** 07-Mar-2022, Pre-QC No: nctj-23-91225 (PQ); **Reviewed:** 21-Mar-2022, QC No: nctj-23-91225; **Revised:** 25-Mar-2022, Manuscript No: nctj-23-91225(R); **Published:** 31-Mar-2022, DOI: 10.4172/nctj.1000136

Citation: Ejike J (2023) Pathophysiology of Anxiety and the Function of Different Stem Cell Types. Neurol Clin Therapeut J 7: 136.

Copyright: © 2023 Ejike J. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

is thought to be the integrator of emotional response and cognition. It is involved in the development of new memories and controls our behavioral responses by comparing new stimulus inputs to previously stored memories. It can be used to distinguish between anxiety and non-anxiety depression. Imaging techniques, particularly magnetic resonance imaging (MRI), have been used in many studies in recent years to identify structural changes in the brain associated with MDD [7].

High-resolution structural imaging showing gray matter thickness and brain morphology. Diffusion tensor imaging (DTI) that can capture white matter and its microstructure. Functional MRI (fMRI), which shows neuronal activity in specific brain regions, is an MRI scan sequence commonly used by researchers. MRI studies have previously shown that patients with MDD have significant impairment in multiple brain regions [8].

Stem cells: An insight

Undifferentiated pluripotent cell types, so-called stem cells, occur at embryonic, fetal and adult stages in almost all organisms. They have the capacity to develop into different types of differentiated cells, depending on their spatial and temporal distribution. Tissue-specific stem cells are present in differentiated organs after birth and in adulthood and play an important role in organ repair after injury. The main characteristics of stem cells are self-renewal, clonality and potency. Embryonic stem cells are derived from the fertilized egg and blastocyst and form the three cotyledons [9].

Germ layers mature into specific organs. Tissue stem cells are found in bone marrow, bone, liver, brain, etc. This is because the specific progenitor cells that contributed to organogenesis have not been clearly differentiated. Tissue stem cells are also called progenitor cells because they necessarily give rise to the differentiated and specialized cells of a tissue or organ. These cells may be dormant within the tissue, but proliferate when injury occurs. In the 1950s, the first attempts at bone marrow transplantation in animal models led to the beginning of modern medical research using stem cells and organ repair. These groundbreaking experiments paved the way for human bone marrow transplantation, a common treatment for various blood disorders, and established a unique tissue regeneration therapy using stem cells. Regenerative medicine is an important research target not only for finding solutions, but also for understanding basic biology and the causes of disease [10].

Neural stem cells and depression

NSCs have garnered interest in recent years with the extensive published literature elucidating that the adult brain maintains multipotent NSCs in contrast to the old dogma of the brain being a generally invariable and quiescent organ that lacks the flexibility to regenerate. With their most generally accepted distinguishing traits, NSCs are also ascribed to the so-called tissue stem cells featuring the power to stay undifferentiated without an outlined phenotype under specific conditions, the power of dividing and proliferating (self-renewal), and also the ability to be differentiated into a progeny like neurons, oligodendroglia, and astroglia upon neurogenesis initiation. They are the unique types of competent cells found within the adult

mammalian brain's "neurogenic" regions, such as the hippocampus, subventricular zone, and neural structures, and might create neurons both spontaneously and in response to local signals induction. Neurogenesis (NG) is assumed to need an explicit set of signaling cues to be delivered to cells that are neurogenic in a very spatially and temporally coordinated manner by their surroundings so as to activate stem cells or progenitors to develop new neurons and, in addition to the well-known modulators, injury is considered to be sufficient to activate neurogenesis. Neurogenesis is also stimulated by the expression of BDNF. NSCs are typically extracted from adult brain tissue, including postmortem brain tissue, and are important candidates for improving or restoring the quality and function of brain tissue affected by CNS disorders. NSCs can be cloned, genetically engineered, or stimulated *in vitro* to transform CNS cell lines. Considerable research is needed to understand how neurogenesis is regulated in adults. For this reason, we found that many endogenous and extrinsic pathways can influence this process.

Conclusions

New pharmacological treatments for depression rely primarily on drugs that target the monoamine neurotransmitter system. This has a delayed effect with lag times of weeks to months before clinical improvements become apparent and provide innovative and diverse options for drug discovery. In depression, decreased hippocampal neurogenesis has been observed. This means that NG deficiency can cause depressive symptoms of depression, and increased NG can mediate antidepressant effects and alleviate symptoms. Differentiated MSCs have promising therapeutic potential to reverse depression-like behaviors.

References

1. Stumpf D (1981) The founding of pediatric neurology in America. *Bull N Y Acad Med* 57: 804-816.
2. Zafeiriou DI (2004) Primitive reflexes and postural reactions in the neurodevelopmental examination. *Pediatr Neurol* 31: 1-8.
3. Sheppard JJ, Mysak ED (1984) Ontogeny of infantile oral reflexes and emerging chewing. *Child Dev* 55: 831-843.
4. Brandt S (1970) A European study group on child neurology. *Neuropadiatrie* 2: 235.
5. Millichap JJ, Millichap JG (2009) Child neurology: past, present and future. Part 1: History. *Neurology* 73: e31-e33.
6. Benvenuto D, Giovanetti M, Ciccozzi A, Spoto S, Angeletti S, et al. (2020) The 2019-new coronavirus epidemic: evidence for virus evolution. *J Med Virol* 92: 455-459.
7. Amiel-Tison C (1968) Neurological evaluation of the maturity of newborn infants. *Arch Dis Child* 43: 89-93.
8. Sheridan-Pereira M, Ellison PH, Helgeson V (1991) The construction of a scored neonatal neurological examination for assessment of neurological integrity in full-term neonates. *J Dev Behav Pediatr* 12: 25.
9. Morgan AM, Koch V, Lee V, Aldag J (1988) Neonatal neurobehavioral examination. A new instrument for quantitative analysis of neonatal neurological status. *Phys Ther* 68: 1352-1358.
10. Romeo DM, Guzzetta A, Scoto M, Cioni M, Patusi P, et al. (2008) Early neurologic assessment in preterm-infants: integration of traditional neurologic examination and observation of general movements. *Eur J Paediatr Neurol* 12: 183-189.