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Letter to Editor

The role of biomaterials in degenerative diseases

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Dear Editor,

According to the evidence, neuroimmune activation plays a crucial role in neurological disorders such as stroke and Parkinson's disease (1). Clarifying immunity is the initial step in properly investigating neuroimmune activation (2). The immune system is a complex information processing system that protects the body against infectious diseases and allergens and maintains homeostasis (3). Two types of immunity exist: innate and adaptive. Adaptive immunity is specific and consists of antibodies and cells, whereas innate immunity is non-specific, has a rapid response, and includes physical agents and chemical components such as cytokines and inflammatory cells (T and B lymphocytes). Typically, innate and adaptive immune systems work in tandem to invade pathogens (4).

In the past, the central nervous system (CNS) was commonly viewed as an immunologically unique organ in which the immune system could not exist under normal circumstances. Neuroimmune signaling has recently been identified as one of the most important mechanisms underlying memory, emotion, and cognition. The CNS is involved in immunological processes under physiological and pathological conditions, and the brain is a highly immunologically active organ due to innate immune cells residing in the CNS and peripheral immune cells invading the brain (5).

Neuroinflammation is currently recognized as a significant factor in almost all neurodegenerative disorders. Microglia are the first line of defense in the brain against pathogens, traumatic brain injury (TBI), and other stresses, and their role in neuroinflammation is crucial (6). Neuroimmune responses in the brain are typically the results of innate immunity. In contrast, the adaptive immune system, such as T-cells, is required for optimal neural activity, memory, and cytokine release in the brain during illness (7). Nonetheless, illness and trauma are evidenced as stimuli that activate the neuroimmune systems. In the homeostatic baseline, neuroimmune signaling interacts with neurons and regulates the neural function and synaptic plasticity (8). During neuroimmune activation, pathological conditions activate endothelial cells, microglia, and astrocytes, which produce cytokines and chemokines (9). As a result, the immune mechanism operates without immune cells entering damaged tissue (10). CNS diseases, such as neurodegenerative disorders, are linked to glial activation, cell migration, antigen expression, and cytokine release. Briefly, neuroimmune activation occurs when microglia are activated or immune molecules, particularly cytokines and chemokines, are overexpressed (11).

Given the role of the immune system in neurodegenerative diseases, targeting immune reactions within the brain may hold great promise as a treatment for these conditions. Consequently, biomaterials that interact with the immune components of the innate immune system, including cytokines, chemokines, complement, neuroglia cells, and astrocytes, have the potential to treat neurodegenerative disorders (12,13).

The use of biomaterials in regenerative medicine has become increasingly important not only for studying disease pathogenesis but also for controlling the delivery of therapeutic drugs to a given site. Therefore, they are widely used to treat neurological disorders and/or improve functional recovery in the CNS.

Conflict of Interests

There is no conflict of interest between the authors.

Ethical Approval

Not applicable.

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