NEURO-INFLAMMATION

Triggers, testing and treatment

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What is neuroinflammation?

Inflammation is an essential biological process triggered by injury, infection and trauma suffered by cells or tissues. A successful inflammatory response eliminates invading pathogens and initiates wound healing and angiogenesis. However, unresolved inflammation can adversely affect recovery and lead to tissue degeneration.[1]

Neuroinflammation is a defence mechanism associated with the response of all brain cells, including neurons, macroglia, and microglia.[1-3] Neuroinflammation is an important feature of many neurodegenerative diseases such as multiple sclerosis, Alzheimer's disease, amyotrophic lateral sclerosis, and Parkinson's disease.[1,4] Neuroinflammation is involved in migraine headaches, cerebrovascular diseases, neurological conditions such as epilepsy, and psychiatric disorders such as depression, bipolar disorder and schizophrenia.[5-7]

In the past, it was believed that due to the blood-brain barrier (BBB), the central nervous system (CNS) was immuno-privileged; however, increasing evidence has disputed this belief. CNS cells seem to be reactive to peripheral inflammatory factors, and peripheral immune cells can infiltrate the brain.[4] Neuroinflammatory diseases cause an impairment of the BBB. The BBB integrity can be impacted by traumatic brain injury, stroke, and even environmental toxins such as aluminium and mercury.[8,9]

What triggers neuroinflammation?

There are several environmental and genetic factors that can trigger, exacerbate, and prolong neuroinflammation. These include certain genetic predispositions, ageing, traumatic brain injury, chronic physical and psychological stress, exposure to environmental toxins, viral infections, autoimmune disease, obesity, and metabolic conditions such as metabolic syndrome and diabetes.[1,4] Gut inflammation is also associated with neuroinflammation. Lipopolysaccharides (LPS), a major component of the outer membrane of Gram-negative bacteria, instigate systemic inflammatory responses, ultimately triggering an inflammatory response in the CNS.[10] Foods, sleep patterns, and physical activity also play a role in neuroinflammation.[11-13] Prenatal stress and childhood trauma also affect the activity of microglia, the resident immune cells of the brain.[14-16]

How to test for neuroinflammation?

Identifying what is happening in the brain can be difficult. Neuroimaging and electroencephalography can provide some insights into neuroinflammation, however specialist referral is required. Assessing for inflammatory biomarkers in the cerebrospinal fluid can be undertaken in exceptional circumstances.[17] Blood markers of inflammation, such as C-reactive protein and cytokine panels, and concentrations of blood markers of autoimmunity can suggest neuro-inflammation.[17,18] Blood concentrations of these markers, however, may not translate into reliable measures of the processes occurring in the brain.

Gut health can be assessed with stool testing. Microbial testing can provide some insights into general gut function and inflammation.[19]

> **Information about neuroinflammation can generally be obtained by conducting a thorough clinical assessment including a history of past and current stressors, traumatic brain injuries, dietary intake, sleep quality, viral infections, and physical activity.**

Reported symptoms of brain fog, low mood, poor memory and concentration, fatigue, headaches, migraines, digestive disturbances, and increased pain sensitivity can indicate potential neuroinflammation. This information can be obtained from a clinical interview and validated self-report questionnaires and symptom diaries.

How to treat neuroinflammation?

Early intervention provides the best treatment outcomes, as prolonged neuroinflammation can lead to irreversible neurological damage.

The brain is incredibly resilient and neuroplasticity can occur despite long-standing neuroinflammation.[20]

As with any condition, the key is identifying potential causes or contributors to a person's neuroinflammation and applying appropriate treatment strategies. These can include teaching stress management, implementing dietary changes, recommending moderate physical activity, incorporating sleep-related changes and education about lifestyle or environmental changes to minimise exposure to environmental pollutants.

Supplementation with certain macro- and micro-nutrients and herbal or plant-based compounds may also be helpful.

Anti-inflammatory nutrients include:

- zinc
- magnesium
- vitamin C
- vitamin D
- omega-3 fatty acids.[21,22]

Anti-inflammatory compounds found in plants, fruits and vegetables, may provide neuroprotective benefits and lower neuroinflammation, include:

- curcumin
- resveratrol
- quercetin
- berberine
- epigallocatechin gallate.[2,23]

Specialised pro-resolving mediators (SPMs) are another potential option to reduce neuroinflammation. SPMs are cell-signalling molecules formed in cells by the metabolism of polyunsaturated fatty acids. SPM supplementation may help support the resolution of neuroinflammation.[24]

Preliminary research presents **probiotics** as another treatment option. Evidence in animal trials indicates that probiotics can reduce LPS-induced neuroinflammation.[25,26]

> **Neuroinflammation is a condition that is associated with an extensive array of conditions and symptomatic profiles.**
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> **Understanding the potential role of neuroinflammation in our clients and implementing strategies to reduce neuroinflammation is important for all health practitioners; not only those practitioners who treat 'brain-related conditions'.**

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