Dynamic Chiropractic

DIAGNOSIS & DIAGNOSTIC EQUIP

New Blood Biomarkers for Alzheimer's, Parkinson's, MS and Traumatic Brain Injury

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WHAT YOU NEED TO KNOW

- The evidence is now present allowing clinicians to aid in the diagnosis, treatment and monitoring of their patients dealing with suspected neurodegenerative conditions via routine blood testing.
- Once thought to be found only in cerebrospinal fluid (CSF), beta-amyloid and tau proteins can now be detected in the bloodstream.
- Just as important is the incorporation of nutritional supplementation to target and lessen oxidative stress factors, reduce the inflammatory process, decrease permeability of the BBB, and slow the hyperphosphorylation and aggregation of tau and beta amyloid proteins.

Until recently, the diagnosis of neurodegenerative diseases such as dementia, Alzheimer's disease (AD), Parkinson's disease (PD), amyotrophic lateral sclerosis (ALS), multiple sclerosis (MS) and traumatic brain injury (TBI) had been made by the combination of evaluating a patient's clinical presentation of symptoms and detecting positive findings on imaging studies such as MRI and PET scan. In many cases, a true confirmation would only occur upon post-mortem brain evaluation.[1]

Glial Cells, Neuronal Proteins & the Precursors of Neurodegeneration

There are approximately 86–100 billion neurons that reside in the human brain, with an almost equal number of the three glial cell types referred to as astrocytes, oligodendrocytes and microglia.[2] While neurons provide the most basic functions in brain cell communication, such as specific signaling protein and neurotransmitter production, glial cells play a role in regulating blood supply to the neurons and myelin production; and also act as the nerve system's resident

immune cells.[3-4]

Normally, upon production of a neuronal protein, a folding process takes place which establishes a number of roles to be performed by that particular protein. In the presence of neurodegenerative diseases such as dementia and AD, there is a misfolding process that takes place, leading to failure of the neuron's cellular and chemical integrity.[5]

The two most notable proteins are referred to as beta-amyloid and tau. These proteins, when altered, begin to aggregate intracellularly as well as in the extracellular spaces, leading to the phenomena described as neurofibrillary tangles and/or plaque formation.[5-6]

As these damaged proteins continue to aggregate over time, neuronal cell communication is lost, leading to symptoms such as memory loss, forgetfulness, mood swings, and/or motor dysfunction.

The Power of Blood Testing

The evidence is now present allowing clinicians to aid in the diagnosis, treatment and monitoring of their patients dealing with suspected neurodegenerative conditions by the use of routine blood testing. Once thought to be found only in cerebrospinal fluid (CSF), beta-amyloid and tau proteins can now be detected in the bloodstream.

In addition to these specific protein markers being detected, some other more subtle markers can be used to evaluate the permeability of the blood-brain barrier (BBB). A faulty BBB can be caused by many factors including underlying pathologies from several different chronic inflammatory conditions.[7] Other common causes may occur from oxidative stress and poor lifestyle choices, which often involves the overconsumption of alcohol, excessive tobacco use, poor diet, and lack of exercise.[8]

Key Lab Biomarkers

The following laboratory biomarkers are now available and have shown great promise in the early detection, diagnosis and management of neurodegenerative processes:

- **Neurofilament Light Chain (NfL)* – A neuron-specific intermediate filament protein that has recently emerged as a biomarker of neuronal injury with great clinical potential. NfL elevation was initially observed in the CSF of people with dementia, including AD, frontotemporal dementia (FTD), and ischemic vascular dementia (IVD). Now available as a blood biomarker, it can be used in cases re-lated to traumatic brain injuries, as well as other progressive neurodegenerative diseases such as AD, ALS and MS.[9]
- **Beta-Amyloid 42/40 Ratio* – A plasma test now available to detect one of the hallmark proteins (amyloid) found in neurofibrillary tangles and plaque formation characteristic in the clinical diagno-\sis of AD.[10]
- **Phosphorylated Tau 181 (pTau-181)* – This plasma test is designed to measure the amount of phosphorylated tau proteins, another hallmark indicator related to the diagnosis of AD and other forms of dementia, in addition to PD.[11]
- *Apolipoprotein E4 Variant (Apo-E4) and Next Generation Sequencing (NGS) Early Alzheimer's Detection Test* – Two individual tests designed to detect the presence of a genetic predisposition to AD and amyloid protein precursors.[12-13]
- *Matrix Metalloproteinase 9 (MMP-9)* – An enzyme vital in the physiological and pathological role of the CNS. MMPs regulate inflammation, microglial activation, blood-brain barrier (BBB) integrity, dopaminergic apoptosis, and alpha-synuclein modulation. MMP-9 prompts the rise in vascular wall permeability by targeting the extracellular matrix (ECM) and tight

junctional properties.[14]
- *Interleukin 17A (IL-17A)* – It is now generally accepted that IL-17A causes disease via the activation of microglial cells and can be used effectively in the diagnosis and treatment monitoring of human autoimmune diseases and neurodegenerative diseases such as AD, PD, MS, and ALS.[15]

*Indicates biotin elimination 72 hours prior to testing.

Treatment and Prevention – Including Supplementation

While no exact causes of neurodegeneration exist, practicing a healthy lifestyle, which includes a balanced diet, getting quality rest and regular exercise, is key in both treatment and prevention.

Just as important is the incorporation of nutritional supplementation designed specifically to target and lessen oxidative stress factors, reduce the inflammatory process, decrease permeability of the BBB, and slow the hyperphosphorylation and aggregation of tau and beta amyloid proteins.

The following nutrients are recognized as necessary in the management and potential prevention of neurodegenerative processes:

- Omega 3 fatty acids (EPA/DHA), in their role as both anti-inflammatories and nerve tissue repair.[16]
- For oxidative stress reduction, glutathione (GSH), Co-Q_{10}, and the lipid soluble vitamins A, D, E and K.[16-19]
- The B-complex vitamins share multiple roles in the production of specific nerve growth factors, while also reducing the production of destructive enzymes and inflammatory cytokines.[16,19]
- Cinnamon and ginko biloba appear to reduce the hyperphosphorylation process of tau proteins, in addition to eliminating the formation of neurofibrillary tangles and beta amyloid aggregation.[20-22]
- Choline and phosphatidylcholine (PC) play multiple roles in blocking amyloid beta plaque devel-opment, in addition to suppressing microglial cell activation and providing fuel for the short-term memory region of the hippocampus.[23-24]
- Alpha-lipoic acid has the ability to aid in the recycling of other antioxidants while also increasing production of GSH.[25]
- Melatonin has been used in the process of an individual reaching delta wave sleep, which is also known to activate the brain's clearing of toxins (glymphatic system); in addition to reducing the MMP-9 enzyme known to degenerate the BBB, leading to increased permeability and toxic uptake into the brain cells.[26]
- Several other nutrients, including huperzine A and acetyl-L-carnitine, are also showing promise in their role of modulating the neurotransmitter acetylcholine at the hippocampal level.

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