Scientists describe biomarkers associated with brain injury

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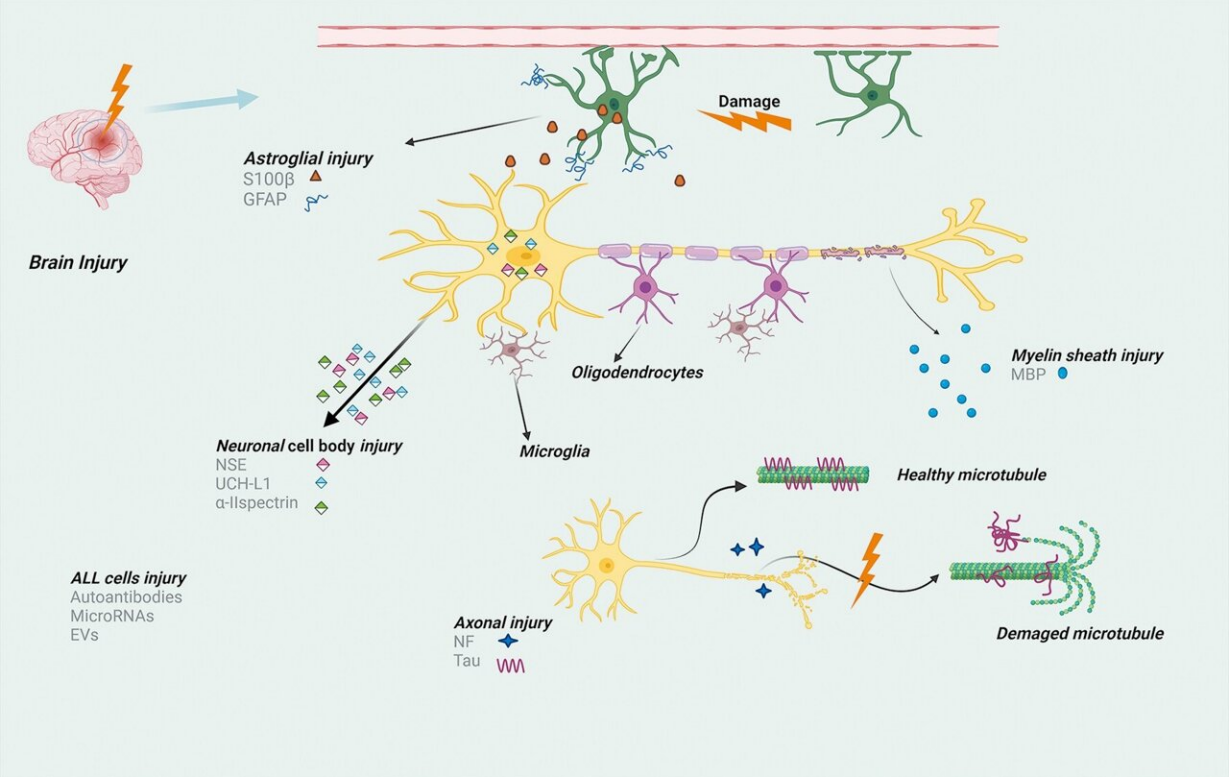

Brain injury is a common pathological process during neurological diseases. Understanding the biomarkers produced after a brain injury may not only help in the diagnosis of the disease but can also provide treatment strategies. Credit: *Chinese Medical Journal* (2024). DOI: 10.1097/CM9.0000000000003061

In recent times, research on brain injury has garnered significant

attention, particularly for understanding the cellular and molecular changes that are associated with neurological diseases. In this context, the study of different clinical biomarkers can shed light on the various pathological processes that lead to brain injury.

To this end, researchers from Jilin University, China, aimed to provide a comprehensive overview of the various biomarkers produced after a brain injury.

"Biomarkers can be objectively measured and evaluated to indicate structural or functional changes in the brain. They can also be used for disease screening, diagnosis, monitoring, and prognosis predicting," says Dr. Han Zhang, from the Department of Neurology, First Hospital of Jilin University, China.

The researchers, in their review article, published in the *Chinese Medical Journal* in March 2024, classified the various biomarkers based on the cell types that produce them.

First, they looked into the biomarkers that indicate injury to the neuronal cell body. These biomarkers include neuron-specific enolase (NSE), which can indicate neuroinflammation, ubiquitin C-terminal hydrolase-L1 (UCH-L1), which can reflect motor function deficits, and a-II spectrin, which is related to neuronal death. Differential levels of these biomarkers can help identify brain injuries.

Next, they noted that biomarkers like neurofilament proteins and tau, which are structural elements of the neuronal cytoskeleton, can indicate damage to axons. The aggregation and misfolding of tau has also been implicated in the development of Alzheimer's disease. Astrocytes are an important part of the blood-brain barrier and account for 30 to 40% of the cells in the central nervous system.

The biomarkers S100β and glial fibrillary acidic protein can be important indicators of the extent of astrocyte damage. The myelin sheath protects axons by functioning as an electrical insulator; its damage can severely impact neuronal communication. Increased levels of myelin basic protein (MBP) can help assess the degree of myelin sheath disintegration.

The researchers note that the hyperfunctioning of the immune system can lead to the activation of inflammatory cascades and autoimmunity. The autoantibodies produced during this process can also serve as biomarkers.

Currently, the most effective autoantibody for the diagnosis of brain injuries includes GFAP and its breakdown products. The researchers also revealed the role of extracellular vesicles and microRNAs as emerging biomarkers that will hopefully help further in simplifying the diagnosis of brain injury.

Next, the researchers also highlighted the role of certain biomarkers in specific neurological disorders. For example, during a stroke, the examination of biomarkers like GFAP can help determine the severity of the brain injury. However, the researchers emphasize that factors like gender and age, among others, should be considered before making a diagnosis based on biomarkers.

The researchers suggest that a single biomarker may not be able to capture the full pathophysiology of any neurological disease, and therefore, multiple indicators and dynamic testing will help in the comprehensive evaluation of brain injuries.

The researchers speculate that these biomarkers can not only make the diagnosis of brain injuries better but may also help in the development of treatment strategies. Elaborating on the possible areas of future

research, Dr. Zhang says, "For biomarkers to be ideal tools for detecting neurological disorders, large-scale multicenter studies are needed to help determine the changes in brain injury biomarkers that have clinical diagnostic significance."

More information: Han Zhang et al, Brain Injury Biomarkers and Applications in Neurological Diseases, *Chinese Medical Journal* (2024). DOI: 10.1097/CM9.0000000000003061

Provided by Jilin University