Physiological mechanism of acupuncture treatment for traumatic brain injury

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Traumatic Brain Injury (TBI), also known as craniocerebral injury or trauma, affects more than 50 million people worldwide each year. To put it simply, TBI The disease weighs heavily upon families, societies, and it can accelerate the development of neurodegenerative diseases such as Alzheimer's. In a paper written by Yuxin Guo, they analyzed selected papers from the last 30 years on the acupuncture treatment of TBI to understand and summarize its clinical value. The main effects of acupuncture focus on the reduction of edema (fluid retention), neuroregeneration, and inflammation.

"Inflammation" refers to swelling of the brain, which can occur after trauma to the brain. Brain swelling is bad for a person's health because it can increase the pressure inside the brain, called intracranial pressure. That pressure can prevent bloodflow and oxygen to the brain, leading to the brain shutting down. As the brain is central to controlling involuntary and voluntary functions of the body, such as breathing, a person can't survive once their brain fails to function. Chemically, TNF - α, IL-6, IL-8 and intercellular adhesion molecule-1 (ICAM-1) are common pro-inflammatory factors that promote inflammation inside the brain. Two studies (1, 2) were found to reduce the content of those chemicals, which are measured in the cerebrospinal fluid. The cerebrospinal fluid is clear, watery liquid which flows between the spinal cord and the brain. A treatment which can reduce the content of these chemicals in the cerebrospinal fluid can be interpreted as evidence of inhibiting an inflammatory reaction. In one of the studies, they needled participants at Kidney-1 and Stomach-45 in addition to conventional medical treatment. The study found significantly higher reductions in the integrative treatment group rather than the conventional medical group alone.

The regulation of neurotransmitters was also a focus of some studies. Neurotransmitters a messengers that deliver chemical information which can lead to pathological reactions in TBI. To put it simply, it is a message that can be sent to different message reception areas that instruct for the production or reduction of chemicals. For example, the monoamine neurotransmitter 5-hydroxytryptamine and norepinephrine (NE) content can be detected 6 hours after TBI, and reach the peak 48 hours after TBI, which will cause a series of pathological or physiological changes, such as intracranial hypertension, pulmonary edema, etc. Electroacupuncture on rats showed a significantly decreased.

Some studies studied the mechanism of neurorepair. Neurons in the brain are basically the center of communication within the brain, working together

as a network of working units. They can transmit information to other neurons, muscles, and other tissues. A few studies showed that acupuncture can regulate brain plasticity, promote axonal regeneration and repair of synaptic structure and function, and play a protective role on neurons in many brain diseases. Wnt3a / β - catenin signaling pathway is one of the classic effective pathways for acupuncture to repair the nerve injury caused by TBI. After TBI, the mRNA and protein expressions of Wnt3a / β - Catenin in brain tissue of rats were down regulated, while acupuncture could increase the expression of Wnt3a / β - Catenin This signaling pathway promotes nerve repair and regeneration [4-7].

Antioxidant production, according to the researchers, could also assist positive recovery of TBI. In the research, the looked at the production of antioxidant superoxide dismutase (SOD). Within the analysis, they also looked at the content of malondialdehyde (MDA), which increased after acupuncture treatment. MDA is the final product of lipid peroxidation in vivo, which can reflect the level of oxygen free radicals in vivo. Acupuncture can reverse this phenomenon It is suggested that acupuncture can eliminate free radicals and reduce brain injury[8].

Brain edema, or fluid retention in the brain, can also increase intracranial pressure. one of the important pathophysiological manifestations of TBI secondary injury is brain edema. Aquaporin 4 (AQP4) is a two-way water transport channel protein. It is an important molecule in the formation and regression of brain edema. A study [9] showed that the protein and mRNA expression of AQP-4 in brain tissue of rats after traumatic brain injury decreased, while the expression of AQP-4 increased after electroacupuncture treatment.

After a person experiences a brain injury, the brain may bleed internally (hemorrhage) leading to ischemia and anoxia of the brain's tissues and cells. Ischemia refers to reduced bloodflow, especially inadequate blood supply to brain tissues. Anoxia means lacking in oxygen. As the brain needs both a high-supply of blood and oxygen to survive, a large reduction can lead to brain cell death, or entire brain failure. Reduction of nutrition to the brain reduces the production of Adenosine Triphosphate (ATP), basically the main unit of energy in the entire body; it's needed for virtually all physiological functions in the body.At the same time of the ATP production decrease, the activities of Na + - K + - ATPase (sodium pump) and Ca2 + - Mg2 + - ATPase (calcium pump) are decreased The amount of Na + and Ca2 + plasma stored in the cells showed hyperosmolar state. A large amount of water flowed passively into the cells, resulting in intracellular edema, cytotoxic brain edema, and vascular brain edema. Acupuncture research showed an improvement of the calcium and sodium pump [10].

The efficacy of acupuncture on TBI is still not valid enough to consider an viable treatment. As the bulk of the research only included animal studies, and the ones including humans didn't specify or use a specified treatment, it is

difficult to evaluate the efficacy of acupuncture for TBI, if any[11]. But these findings show considerate need and enough evidence to substantiate a need for further research on research of adequate quality to ethically inform clinical practice. It was also found that rats were omitted from the studies for showing adverse effects, but the researchers didn't report that as a negative side effect of acupuncture, which brings into question the degree of bias in the clinicians' observation and interpretation of the clinical trials. Yet the aforementioned aspects of observable changes could set a standard for more rigorous research into the efficacy of acupuncture in the treatment of TBI.

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