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**The Diagnosis and Treatment of Brain Fog of Covid 19 Survivors
An Alternative View from Traditional Chinese Medicine**

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The Diagnosis and Treatment of Brain Fog of Covid 19 Survivors

An Alternative View from Traditional Chinese Medicine

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ABSTRACT

Brain Fog, as a new syndrome, with the symptoms of slowed-down cognitive response, memory loss, inability to concentrate, or/and the symptoms of dizziness and sleep disturbance, are commonly observed and considered as the consequence of long Covid. Studies on this new syndrome are few, but the number of patients has kept rising, along with the increasing infection of the ongoing Covid-19 pandemic. Brain Fog has, therefore, developed as one of the biggest crises in the modern medical system and a constant threat to the wellbeing of contemporary society. Following the previous studies, we aim to provide an alternative and supplement view in diagnosing and treating Brain Fog from the traditional Chinese medicine (TCM) perspective, with a list of TCM treatment approaches (including Chinese Herbal Medicine, Acupuncture, Dietary conditions, and others), based on the TCM theory that implies Brain Fog origins from the heart, appears in the brain. Our proposed TCM treatment applies the principle of combining heart and brain, in terms of nourishing the heart, tranquilizing the mind, clearing orifices, and the refreshing brain. Together with the proposed TCM treatments, we expect this paper to bring an alternative understanding of Brain Fog and an economic healing approach to help Covid-19 survivors improve their well-being.

KEYWORDS: Brain Fog; Long Covid; Chinese Traditional Medicine

INTRODUCTION

"Brain Fog" is not a medical terminology, but a cool term used to describe slow or fuzzy thinking and slowed-down cognitive response. The symptoms differ depending on the different body constitutions of patients, such as symptoms of confusion, memory loss, difficulty recalling words, slow thinking, difficulty concentrating, and being easily distracted. Brain Fog symptoms can appear during the recovery period after many viral infections. Serena Spudich, a professor of neurology at Yale University, reported that a person seems to experience more cognitive slowing and emotional problems after contracting the coronavirus than most of the other viral infections. Neurological symptoms occurred in 80% of hospitalized patients with COVID-19 investigated in one study (Chou, 2021). A survey study published in *Eclinical Medicine, The Lancet* showed that in 3,762 people with confirmed or suspected COVID-19, 85% reported Brain Fog (Hannah and Davisa.2021). According to a study published in *PLoS Medicine* in September 2021, 36.55% of people infected with COVID-19 recover with sequelae, 3-6 months (Maxime, 2021). With very little limited understanding, this condition is often referred to as the consequence of long COVID and has become a common and particularly difficult problem for all nations' medical systems and medical care providers. In this work, we aim to provide an alternative view (TCM) in understanding Brain Fog and introducing the approaches that TCM treats such a syndrome.

THE PATHOGENESIS OF BRAIN FOG

Lab-based Western Medicine (WM) explanation

A recent study published in "Nature" shows strong evidence for brain-related abnormalities in COVID-19. In this study, researchers investigated brain changes in 785 UK-based participants (aged 51-81 years) who underwent imaging twice. The study captured reduced grey matter thickness and tissue contrast in the orbitofrontal cortex and para hippocampal gyrus, which is correlated with changes in functionally relevant regional tissue damage markers, and overall causes brain-capacity reduction. This explains why infected participants also exhibited greater cognitive decline on average between the two-time points. However, whether such deleterious effects can be partially reversed or whether these effects will persist in the long term remains to be further investigated (Gwenaëlle, 2022). Even with the recent clear evidence of brain grey/tissue damage, the theoretical explanations of Brain Fog from the western medicine colleagues are still not clear and consistent. In general, there are three propositions.

The first proposition is the SARS-CoV-2 breaking into the brain. This proposition was raised up since the covid pandemic started, however, the result was not consistent. In a study by Columbia University published in September 2021, there was no evidence of coronavirus RNA or protein found in brain cell samples from 41 people who died of COVID-19 (Kiran and Thakur, 2021). However, another study (Andrew et al., 2021) reported that SARS-CoV-2 preferentially infects astrocytes over other brain cells. The researchers exposed brain organoids --- miniature brain-like

structures grown from stem cells in the lab --- to the virus, and found that SARS-CoV-2 almost exclusively infected astrocytes over all other cells present. According to this research team, infected astrocytes could explain some of the neurological symptoms associated with COVID-19, especially fatigue, depression, and 'Brain Fog,' which includes confusion and forgetfulness.

The second proposition is that SARS-CoV-2 can affect the brain by reducing blood flow, impairing neurons' function, and ultimately killing them. The study by David Attwell, a neuroscientist at University College London, and his colleagues (2021) published a preprint showing the evidence that SARS-CoV-2 can affect pericytes' behavior. In slices of hamster brain, the researchers observed that SARS-CoV-2 blocks the functioning of receptors on pericytes, causing capillaries in the tissue to constrict.

The third proposition is coronavirus causes the body's immune system to overreact and even misfire with neurological symptoms and damage. A study issued in March 2021 found autoantibodies in the cerebrospinal fluid of COVID-19 patients with neurological symptoms (Franke, 2021). This result suggests that the generation of Brain Fog may have its pathological material basis, and it is not entirely a psychological problem. Another research (Franke et al., 2021), studying the blood and cerebrospinal fluid of 11 people critically ill with COVID-19, found that all people had neurological symptoms. All produced autoantibodies are capable of binding neurons. The evidence supports giving patients intravenous immunoglobulin, another type of antibody, to suppress the harmful autoantibodies' action.

Evidence-based TCM explanation

In comparison, Traditional Chinese Medicine has helped China and Chinese population survived through more than 3000 years in which China experienced numerous pandemics, however, without significant population loss and wellbeing reduction. Historically, the advantage of TCM approach has been marked as a natural healing process with nearly no side effect, low recurrence rate, and economical healing approach.

Regarding the three WM propositions above, TCM theories have clear interpretations correspondingly, regarding the disease's (Brain Fog in this case) pathogenic development path and nature.

Regarding the pathogenic development path, the first WM proposition (virus breaking in) can be corresponded with TCM's interpretation of exogenous evils breaking in, causing pathogens to invade through the layers of Wei, Qi, Ying, Xue (from external to internal) and various organs. The second WM proposition (virus blocking blood flow into the brain) typically corresponds to a TCM's interpretation of exogenous evil causing blood and qi stagnation. TCM can explain the third proposition (autoimmune reaction) as the consequence of a mess of phlegm and dampness, disharmony and mis-correspondence amongst Zang-Fu, and insufficient endowment from the genetic constitution.

In terms of nature, TCM believes that the heart dominates people's spiritual consciousness activities. "Huang Di Nei Jing" (Inner Canon of the Yellow Emperor) recorded: "The heart is the official of the monarch, in charge of the consciousness." ZHANG Jiebin (a Chinese Physician, 1563-1640) explained: "The heart is the king of a body, with a vain spirit and the ability to cope with many changes. All the internal organs and the whole body are controlled by the heart. Thus, wisdom and spirits, and consciousness come from the heart". In the words of Traditional Chinese Medicine, the brain belongs to the "extraordinary Fu-organ, "with a function in regulating mental activities. JIN Zhengxi, a TCM guru from China's Qing Dynasty (1598-1645) said: "The memory and inspirations lie in the brain. Children's brains are not full but gradually growing. Old people's brains gradually empty, therefore with memory decline."

There have been some debates in Traditional Chinese Medicine about whether the heart dominates the mind, or the brain dominates the mind. Professor DENG Tietao (2003) published the article "The scientific evidence of the Theory of Heart Dominates the Mind" in the journal of New Chinese Medicine with the opinion that "the theory of heart dominating the mind comes from practice, which in turn can guide clinical practice. Practice is the criterion for testing the truth. Therefore, this theory is scientific". Tang (2004), in his article "A Joined Discussion about the Heart and Brain Dominating the Mind," extended Deng's work by arguing the mechanism of the heart dominating the mind as the root and the brain dominating the mind as the branch. According to the principle that treatment must be based on the origin of the pathology, TCM's treatment of Brain Fog should focus on nourishing the heart and tranquilizing the mind simultaneously while opening the orifices of the brain.

In addition, according to the TCM theory, (1) Kidneys govern bones, while bones generate marrow, and marrow nourishes the brain, so nourishing kidneys and filling the essence of the kidney is equal to nourishing the brain; (2) Liver controls stagnation, regulates qi, thus, relieving the stagnation of liver qi can help relieve depression; (3) Spleen is the source of qi and blood, meanwhile related to thinking. Therefore, strengthening the spleen and nourishing qi can indirectly nourish the heart and calm the nerves. Although Brain Fog is in the brain, regulating the function of five Zang Organs will be able to achieve the purpose of treatment. Nourishing the heart and calming the nerves should be the focus.

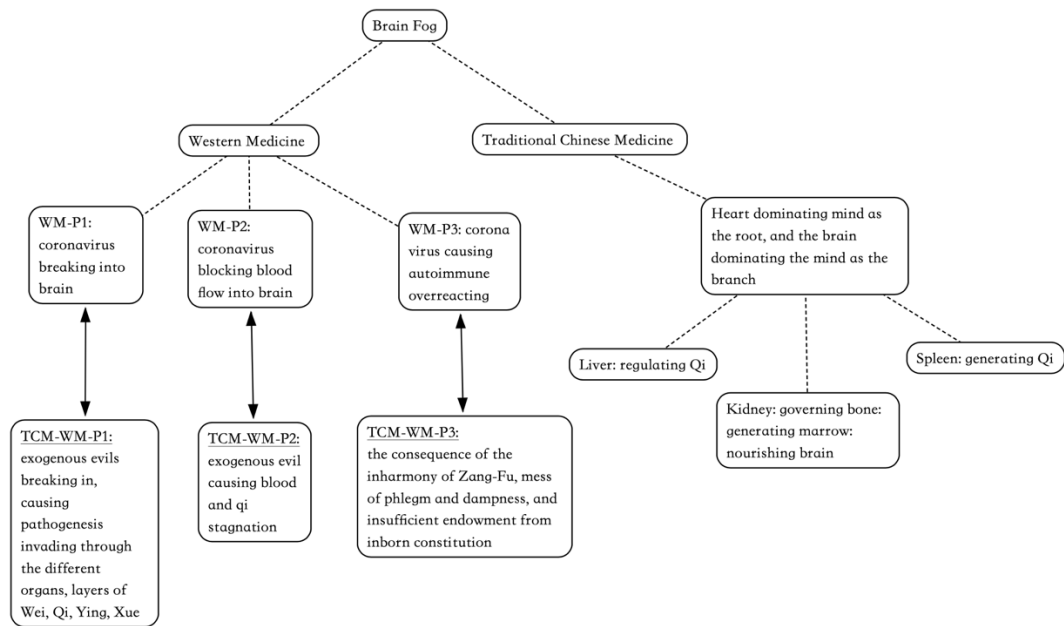


Figure 1. Figure: Summary of TCM and WM in understanding Brain Fog

CHINESE AND WESTERN MEDICINE IN TREATING BRAIN FOG

Western Medicine Treatment

Western Medicine believes that cognitive rehabilitation seems to be the best way to treat brain fog. Usually, it is performed by a neuropsychologist, consisting of written and oral examinations that focus on strategies to improve specific brain functions, such as attention or memory. Cognitive rehabilitation is like physical therapy, with the target of the brain. Many hospitals in the U.S. currently have cognitive rehabilitation programs, and many long COVID clinics also offer brain fog treatment. There is some evidence that playing games like CogMed, Lumosity, etc., on a computer or mobile phone can also improve cognitive performance, as a great addition to cognitive rehabilitation therapy.

In terms of drug therapy, the United Kingdom has recently launched a combination preparation for the treatment of Brain Fog called Brainzyme, which includes EMT mixture (theanine, EGCG and polyphenols), guarana seeds, choline, ginkgo biloba, L-Tyrosine, Piperine, Bromelain, Maca Root, Vitamins and Minerals. Among them, ginkgo biloba and pepper are the ingredients of Traditional Chinese Herbal Medicine. The others are primarily nutritional additives, which are also contained in many Chinese herbs. The effectiveness of Brainzyme in treating Brain Fog has not been reported.

Traditional Chinese Medicine Treatment

Herbal Medicine

TCM treats Brain Fog based on the principle of syndrome differentiation. According to our clinical experience and numerous successfully treated cases, there are mainly four common syndromes associating to Brain Fog.

(1) Heart-blood deficiency and heart-yin deficiency:

Main symptoms: Memory loss, lack of concentration, insomnia and dreaminess, dizziness and fatigue, pale complexion or red cheeks, or night sweats or spontaneously sweat, pale tongue or red tongue with little coating, deep and thin pulse.

Treatment principles: Nourishing Yin and nourishing blood, calming the mind and the nerves.

Formula selection: Modified Bai Zi Zi XinWan

Herbs selection: Baiziren, Xuanshen, Shudihuang, Gouqizi, Zhigancao, Danggui, Shichangpu, Maimendong, Fuling.

For those with more blood deficiency, add Jixueten, Heshouwu;

For those with more Yin deficiency, add Baihe, Tianmendong;

For those with sleep disorders, add Suanzaoren, Yejiaoteng.

(2) Disharmony between the heart and kidney:

Main symptoms: Forgetfulness, insomnia, trance, dizziness, palpitations, soreness and weakness of waist and knees, hot flashes and night sweats, tinnitus, red tongue with little or no coating, rapid pulse.

Treatment principles: Nourish Yin and calm the mind, regulate heart and kidney.

Formula Selection: Tian WangBu Xin Dan

Herbs selection: Baiziren, Suanzaoren, Maimendong, Tianmendong, Shengdihuang, Xuanshen, Taizishen, Wuweizi, Danggui, Yuanzhi, Hehuanpi, Yizhiren.

For those with kidney deficiency, add Xuduan, Duzhong;

For those with heart fire, add Zhizi, Huanglian.

(3) Liver qi stagnation:

Main symptoms: Depression, restlessness, irritability, forgetfulness, dreaminess, dizziness, hypochondriac distension, red eyes and bitter mouth, thin white or yellow tongue coating, wiry pulse.

Treatment principles: Soothe the liver and relieve depression, calm the heart and mind.

Formula Selection: Modified XiaoyaoWan

Herbs selection: Chaihu, Danggui, Baishao, Fushen, Baizhu, Xiangfu, Qingpi, Yujin, Zhigancao.

For those with more liver fire excess, add Mudanpi, Zhizi;

For those with severe emotional depression, add Suxinhua, Meiguihua, Jianghuang;

For those with bitter taste in the mouth, add Longdancao, Xiakucao.

(4) Heart and spleen deficiency:

Main symptoms: Forgetfulness, anxiety, lack of concentration, fatigue, palpitations, insomnia, loose stools, or abdominal distention, pale tongue, fat tongue with tooth marks, white and slippery coating, slow pulse.

Treatment principle: Nourish the heart and spleen, soothe the nerves.

Formula Selection: Modified Guipi Wan

Herbs selection: Renshen, Huangqi, Baizhu, Danggui, Fushen, Yuanzhi, Suanzaoren, Longyanrou, Wuweizi, Zhigancao.

For those with spleen deficiency and loose stools; add Yiyiren, Cheqianzi;

For those with abdominal distension, add Muxiang, Sharen;

For those with poor appetite add Maiya, Guya;

For those with severe memory loss, add Yizhiren and Shichangpu.

Acupuncture

In addition to herbal treatment, acupuncture is also an effective means of treating post-COVID-19 Brain Fog. Mainselected points can be on the Heart Meridian of Hand Shaoyin, the Pericardial Meridian of Hand Jueyin, the Liver Meridian of Foot Jueyin, the Kidney Meridian of Foot Shaoyin, the Du Meridian, and local acupuncture points on the head. Scalp acupuncture can also be used entirely. Electro-acupuncture can be applied too.

Diet and Others

Healthy diet can also help Brain Fog recovery. A healthy diet (including olive oil, fruits and vegetables, nuts and legumes, and whole grains) has improved thinking and memory. Other advice to help eliminate Brain Fog symptoms include avoiding alcohol and drugs, getting enough sleep, listening to music, doing regular aerobic exercise, and participating in social activities.

CONCLUSION

Brain fog is very common in the duration of COVID 19 infection and its aftermath. Western Medicine usually applies cognitive rehabilitation therapy to treat Brain Fog, while Traditional Chinese Medicine apply herbals to treat based on a TCM theory that many organs (liver, kidneys, spleen) can affect on brain capacity, however, the brain is mainly charged by the heart. This paper suggests that Chinese herbal medicine can be a very effective alternative or/and supplement treatment to eliminate Brain Fog, with the principle of combining heart and brain in the treatment, by nourishing the heart, tranquilizing the mind, clearing the orifices, and refreshing the brain.

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