Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Letter to the Editor

The potential role of inflammation reaction in COVID-19 related posttraumatic stress disorder

As of 7th July, 2020, more than 11,700,000 people worldwide have been confirmed to get COVID-19 (Velavan and Meyer, 2020). The rapid pandemic has posed serious threats to physical and mental health of people all around the world. Posttraumatic stress disorder (PTSD) is a post-traumatic event that occurs during unbearable experience, such as torture, accident, violent assault or natural disaster, which was manifested as persistent trauma, evasion of related stimuli, emotional indifference and physiological irritability (Eurosurveillance, 2020). The prevalence of PTSD in trauma survivors is 7–12 % . During SARS occurred in 2003, approximately 10 % of people developed symptoms of PTSD and nearly 20 % patients got PTSD during Ebola virus outbreak in West Africa (Koenen et al., 2017). The COVID-19 pandemic could be recognized as a bio-disaster followed by a psychological impact. Going through COVID-19 could be a traumatic experience. PTSD would develop into long-term psychiatric disorders among survivors of COVID-19 without timely intervention. Unlike the commonly described PTSD, PTSD caused by biological disasters might be complicated and chronic (Banerjee and Viswanath, 2020). With the increasing global burden of the SARS-CoV-2 during this pandemic, preliminary data on COVID-19 related PTSD have been reported. It is necessary to discuss and review the current data on high prevalence of PTSD and its potential mechanisms, and measures should be timely taken to prevent the occurrence and development of PTSD (Tandon, 2020).

COVID-19 is an infectious disease which can cause inflammation reaction in lung and other organs or tissues. Peripheral inflammatory cytokines could affect the brain through various mechanisms. The common pathway includes active transport through blood-brain barrier (BBB), leaky area of BBB, activation of vagal nerve or other neural pathways. Therefore, the peripheral inflammation caused by COVID-19 can lead to neuroinflammation by activating astrocytes and microglia (Fig. 1). Particularly, IL-1β, TNF-α and IL-6 plays potential role in the synaptic plasticity, neurogenesis, and memory/learning from the morphological, functional and cognitive levels, presenting with PTSD symptoms. Another mechanism of widespread concern is that

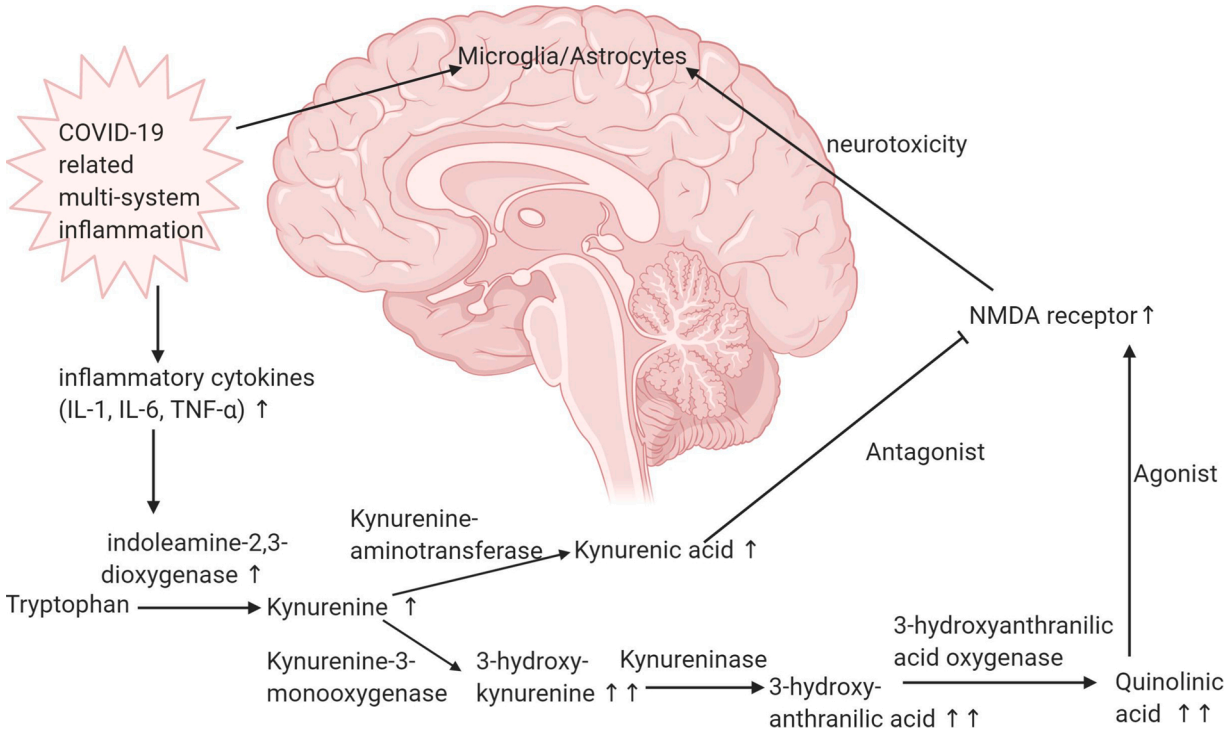

Fig. 1. COVID-19 related inflammation reaction and pathogenesis of PTSD.
The peripheral inflammation caused by COVID-19 can lead to neuroinflammation by activating microglia and astrocytes.

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proinflammatory cytokines induced by COVID-19 upregulate indoleamine 2,3-dioxygenase, which was the initial and speed-limiting enzyme of tryptophan degradation pathway (i.e., kynurenine pathway). The activation of indoleamine 2,3-dioxygenase results in the decrease of tryptophan concentration and the increase of tyrosine production. After that, tyrosine is transformed into several metabolites, containing quinoline acid and tyrosine acid, which then activate and inhibit NMDA neurotransmission, respectively (Hori and Kim, 2019). In the inflammatory state, quinolinic acid production is relatively higher than kynurenic acid, resulting in neurotoxicity caused by NMDA receptor (Dowlati et al., 2010). In addition, the increase of pro-inflammatory cytokines leads to the decrease of 5-hydroxytryptamine production by promoting the decomposition of tryptophan (Howren et al., 2009). Glucocorticoids could also participate in the activation of tyrosine pathway induced by COVID-19 related inflammation reactions (Myint et al., 2012).

The COVID-19 pandemic contributes to the high prevalence of PTSD in the hardest-hit areas. The peripheral inflammation caused by COVID-19 is the potential role in the pathogenesis of PTSD, manifested as persistent trauma, evasion of related stimuli, emotional indifference and physiological irritability, which takes great impact on people's normal life. Strengthening the attention to the possible neuropsychiatric consequences of SARS-Cov-2 infection may contribute to early identification and better management (Dinakaran et al., 2020). It is urgent to recognize the high prevalence of PTSD and certain measures should be timely taken to prevent PTSD developing into long-term chronic psychiatrically problems.

Contributors

YJ and ZH drafted the manuscript. YJ wrote the manuscript and figure. YJ, LM and YZ were responsible for editing the manuscript. All authors accept responsibility for the entire content of this submitted manuscript and have approved its submission.

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Declaration of Competing Interest

The authors report no declarations of interest.

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