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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Editorial

In the spiral of history: SARS-Cov-2 infection

See Article, pages 1974–1981

The post-viral fatigue syndrome, or myalgic encephalomyelitis, has been accepted as a complication of a previous viral infection, affecting a variable number of people, occurring mostly in epidemics, but sporadic cases may occur (Thomas, 1987). The symptoms of easy fatigability last for more than 6 months, and are frequently associated with other symptoms, such as weakness, myalgia, arthralgia, irritability and headaches (Lask and Dillon, 1990). Abnormal virus antibodies or a dysfunctional immunological response were described, but findings have not been consistent (David et al., 1988). Minor changes on muscle biopsy were reported. Psychological disturbances were also considered relevant, but the results have been admittedly uncertain (David et al., 1988). Motor unit potentials (MUP) seem to be unaffected in this condition (Alexander, 1956), nonetheless abnormal jitter was described in one study (Jamal and Hansen, 1985), which was not replicated in a later study (Roberts and Byrne, 1994).

Coronavirus disease 2019 (COVID-19), the disease caused by infection with serious acute respiratory syndrome coronavirus 2 (SARS-Cov-2), is a recent pandemic, mainly associated with pneumonitis and hypoxic respiratory failure. A number of neurological complications have been reported, the most serious ones are associated with neurovascular and thromboembolic disease (Ren et al., 2021), encephalitis and encephalomyelitis (Shehata et al., 2021). Nevertheless, other immunologically-related neurological complications have been described, in particular Guillain-Barré syndrome and myasthenia gravis (Ren et al., 2021). In addition, many patients suffer from neurologic sequelae of critical weakness (Ren et al., 2021), intensive care unit acquired weakness (ICUAW), as described for other patients in intensive care units (ICU) with severe medical conditions (de Carvalho, 2020). It was reported that critical illness neuropathy is a more common complication in COVID-19 patients with ICUAW (50%) than in other conditions developing ICUAW (Frithiof et al., 2021).

A number of chronic neurological symptoms have been related to previous SARS-Cov-2 infection such as headache, dizziness, depression, anxiety, hyposmia and hypogeusia (Shehata et al., 2021). After acute infection, 26–51% of patients complain of fatigue and 3–64% of myalgia, including patients not requiring ICU assistance (Tsai et al., 2020). In a recent study selecting 12 COVID-19 patients (8 with sequelae of acute neuromuscular complications) fatigue was correlated with the lack of the physiological post-exercise reduction of the motor response amplitude evoked by transcranial magnetic stimulation, and with a paradoxical increase of the cortical silent period duration after exercise, both suggesting a cortical GABAergic dysfunction (Ortelli et al., 2021), possibly caused by a hyper-inflammatory damage of GABA receptors (Garcia-Oscos et al., 2012). However, muscle fiber lesion can also be related to the symptoms of fatigue and weakness. More than 25% of the patients have increased CK levels at emergency room arrival, in particular patients with respiratory-failure, and this finding is a prognostic factor of mortality (Pitscheider et al., 2021; De Rosa et al., 2021), being associated with a number of inflammatory markers (Pitscheider et al., 2021).

In this issue of *Clinical Neurophysiology*, Agergaard et al. (2021) report their findings investigating 20 patients with persistent neuromuscular symptoms following SARS-Cov-2 infection. They did not stay in ICU and were not affected by a previous neuromuscular disorder, all keeping some physical activity at the time of investigation. Most patients complained of myalgia and fatigue, and proximal muscle weakness was disclosed in some patients. Nerve conduction studies were unremarkable and CK levels were normal. MUP analysis was performed in the biceps brachii of all patients, vastus medialis in 9 and anterior tibial muscle in 10. None had fibrillation potentials or positive sharp waves, in any of the examined muscles. In 11 patients, MUP analysis showed myopathic changes in one or more muscles (in particular shorter MUP duration), as compared with healthy controls. These changes were associated with symptoms of fatigue and myalgia, as well as with muscle weakness. Considering the absence of additional support for the diagnosis of myopathy, e.g., by muscle biopsy and/or muscle MRI, the authors carefully concluded that myopathic changes on MUP analysis is a common finding in symptomatic post-COVID-19 patients, and that muscle fiber lesion can be a significant cause of myalgia and fatigue in these patients.

Some claim that the history moves in spirals: in a spiral a fact or observation come closer to the same point in the previous cycle than you are to the most distant point of the same cycle. Science can follows the same principle, sometimes. The problem of chronic symptoms after a viral infection is not new, and probably includes psychological factors, persistent immunological dysfunction, central motor pathways abnormalities, end-plate changes, and muscle fiber anomalies, affecting people in varying proportions. This study (Agergaard et al., 2021) indicates that we should re-approach muscle fiber lesion in patients with chronic neuromuscular symptoms after acute viral infection, as in COVID-19. Surely, muscle biopsy

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has a relevant role for giving critical supplementary information, and should be added in future studies (Bove et al., 1983).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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