



Long COVID and autism spectrum disorders – a narrative review¹

[https://doi.org/ 10.34766/fetr.v56i4.1242](https://doi.org/10.34766/fetr.v56i4.1242)

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Abstract: *Introduction:* COVID-19 disease may have long-term consequences, called long COVID. They concern symptoms (most often neurological and neuropsychiatric) lasting ≥ 12 weeks without another diagnosis and a predictable time of resolution. They become a diagnostic and therapeutic problem in patients with previously observed behavioral disorders, e.g. in people with autism spectrum disorders (ASD). Most published studies on long COVID mainly focus on adults, and there is limited information on the pediatric population. There is also not much information in the available literature about long COVID in people with autism spectrum disorders. The main aim of this narrative review is to present the problem of long COVID in people with autism spectrum disorders. *Method:* Based on a review of the current literature based on the EBM (Evidence-Based Medicine) paradigm, the problem of long COVID in autism spectrum disorders is presented. During data collection, the PubMed search engine, which supports the MEDLINE database, and the Google Scholar search engine were used. The criteria used to search for articles are works published since 2022, available in Polish or English. *Results:* The pandemic has deepened behavioral disorders related to the autism spectrum disorders. The occurrence of COVID-19 and subsequent symptoms associated with long COVID was and is more common in people with ASD. *Conclusions:* COVID-19 has a significant impact on neuropsychiatric symptoms in people with autism spectrum disorders. Difficulties have been observed in the treatment of long COVID in patients with ASD. There is a need to increase the awareness of parents, health care workers, and scientists about the effects of SARS-CoV-2 infection in the population of people with autism spectrum disorders. This is necessary to understand the consequences of the disease, speed up diagnosis and provide appropriate specialist help.

Keywords: ASD, autism, long COVID, post COVID

1. Introduction

The pandemic announced in 2019 caused by the SARS-CoV-2 virus causing the coronavirus disease COVID-19 has led to global crises in health and social support for entire populations. It particularly affected the elderly, the poor and people with disabilities, including: autism spectrum disorder (ASD) (Karpur et al., 2022). As it turned out, focusing mainly on the acute phase of the disease is not enough. Many people, after a few months, still experience or have experienced negative symptoms of SARS-CoV-2 infection, which required additional medical intervention and further observation (Lopez-Leon et al., 2022).

COVID-19 disease caused by the SARS-CoV-2 virus may have long-term consequences, currently referred to as long COVID. They concern symptoms (most often neurological and neuropsychiatric) lasting ≥ 12 weeks without another diagnosis and with a predictable time of resolution (Jyonouchi et al., 2022; Sharma et al., 2022). They become a serious diagnostic and therapeutic problem in patients in whom behavioral disorders have been previously observed, e.g. in people with autism spectrum disorders (Jyonouchi et al., 2022).

Long COVID affects children and adults. However, its frequency in children is not fully known (Ludvigsson, 2021; Zimmermann et al., 2021). The most

¹ Article in polish language: Long COVID i zaburzenia ze spektrum autyzmu – przegląd narracyjny, https://www.stowarzyszeniefidesetratio.pl/fer/2023_4Zale.pdf

frequently reported symptom is cognitive dysfunction (including disturbances in concentration, attention and memory, as well as the speed of information processing, which may be accompanied by anxiety, fatigue and sleep disorders), referred to as „brain fog” and affecting one in 4-5 patients after COVID-19 (Ceban et al., 2022).

Autism spectrum disorder is a complex developmental disorder characterized by impaired social communication and repetitive/restrictive behavior patterns (Rosen et al., 2021). When a child with intellectual disability or other previously diagnosed neuropsychiatric disorders develops brain dysfunction caused by the SARS-CoV-2 virus, distinguishing the symptoms of long COVID becomes a huge diagnostic challenge. It turns out that it is possible to reject neurological and neuropsychiatric symptoms associated with long COVID and treat them, for example, as typical behaviors related to ASD (Jyonouchi et al., 2022).

Most published studies on long COVID mainly focus on adults, and there is limited information on the pediatric population (Lopez-Leon et al., 2022). There is also not much information in the available literature about long COVID in people with autism spectrum disorders.

The main aim of this narrative review is to present the problem of long COVID in people with autism spectrum disorders.

2. Method

Based on a review of the current literature based on the EBM (Evidence-Based Medicine) paradigm, the problem of the so-called long COVID in autism spectrum disorders. During data collection, the PubMed search engine, which supports the MEDLINE database, and the Google Scholar search engine were used. All articles included in the review were archived in electronic form—in the form of PDF files. The criteria used to search for articles are works published from 2021, available in Polish or English. The following keywords were used: long COVID, post COVID, ASD, autism.

3. Results

3.1. COVID-19 and the autism spectrum disorders

The COVID-19 pandemic has resulted in aggravation of behavioral disorders related to the autism spectrum disorders, reduced sleep quality and increased sensitivity to stimuli (Mutluer et al., 2020). Parents and guardians of people with ASD reported new problems in managing free time and organizing activities during the pandemic (Colizzi et al., 2020). However, people on the spectrum had problems with understanding the need to maintain social distance and the obligation to use personal protective equipment in every situation (Karpur et al., 2022).

Statistical data on clinical experiences (e.g., incidence of COVID-19) and hospitalizations of people with autism spectrum disorders during the pandemic are insufficient (Karpur et al., 2022). The occurrence of COVID-19 and subsequent symptoms associated with long COVID was and is more common in people with ASD. The risk of hospitalization in people with ASD during the pandemic was nine times higher due to SARS-CoV-2 virus infection, and the risk of longer hospitalization was almost six times higher (Karpur et al., 2022). This is related to the increased concentration of pro-inflammatory cytokines occurring in chronic conditions, which are a risk factor for COVID-19 (Jyonouchi et al., 2019). The overlap of neuroinflammatory pathophysiology in ASD and COVID-19 has exacerbated challenging behaviors and mental health issues (Lima et al., 2020), as well as long COVID symptoms. Typical features of SARS-CoV-2 infection were observed in people with ASD (fever, cough, sore throat, musculoskeletal pain, headaches, fatigue, smell and taste disorders, shortness of breath), but there were also specific symptoms that made diagnosis difficult and treatment (Nollace et al., 2020).

Increased stress levels both before, during and after the pandemic are observed not only in children with ASD, but also in their families. Among the long-term effects of the COVID-19 pandemic is a negative impact on the behavior of people with autism spectrum disorders, which is found to be related to the level of anxiety in their mothers (Aslan et al., 2023).

Symptoms coinciding with features of post-traumatic stress disorder have been observed in patients with autism spectrum disorders in connection with the COVID-19 pandemic, which confirms the thesis that the pandemic was a traumatic event for many people with ASD and others (Mutluer et al., 2020). Such disturbing behaviors include: behavioral difficulties, intense stereotypes, difficulty concentrating, psychomotor hyperactivity, deepening social communication disorders, and sleep disorders (Peterson et al., 2019). Long-term symptoms may also develop as a result of deterioration in adaptive functioning, usually in the social sphere (observed 6 months to 1 year after the traumatic event) (Valenti et al., 2012).

3.2. Long COVID and the autism spectrum disorders

Two long-term consequences of COVID-19 disease are most often observed in children: multisystem inflammatory syndrome (MIS-C) and long COVID. Both can develop even in asymptomatic patients (Kundu et al., 2022). MIS-C is a condition in which various parts of the body become inflamed (it occurs in less than 0.01% of infected children and requires intensive care in 68% of cases) (Helms et al., 2020).

Symptoms of long COVID may include, for example, cough, shortness of breath, headache, and musculoskeletal pain (Aiyegbusi et al., 2021). Neuropsychiatric symptoms of long COVID most often manifest themselves as cognitive impairment (loss of concentration or memory problems), headache, sleep disorders, symptoms of peripheral neuropathy (tingling and numbness), dizziness, anosmia, symptoms of depression, anxiety and fatigue. Patients with long COVID report a decreased quality of life with difficulties in everyday functioning (Roesch Ely et al., 2022). The term „brain fog” is a collective term for symptoms reported by some patients who have recovered from COVID-19 and observed temporary or permanent cognitive impairment. These symptoms concern patients infected with SARS-CoV-2, who also developed a mild form of the disease. „Brain fog” includes deficits in: attention, executive functioning, language, information processing speed and

memory. „Brain fog” caused by SARS-CoV-2 (and not e.g. ASD) is often difficult to diagnose because longitudinal neurocognitive data regarding individual are usually not available (Venkataramani, Winkler, 2022).

The burden of the disease develops more often in women, smokers, and in patients with comorbidities. People with ASD, compared to neurotypical people, usually have greater needs related to medical care, which are related to the co-occurrence of other diseases, e.g. of the nervous or digestive system, and mental disorders (Karpur et al., 2018; Shea et al., 2018). The symptoms characteristic of long COVID are similar to those of chronic fatigue syndrome (CFS), which is caused by infectious diseases (Astin et al., 2023).

A large percentage of people with autism meet the diagnostic criteria for CFS, as well as other disorders characterized by central sensitization (CS). In the CS theory, the nervous system responds with an enhanced response to certain stimuli (e.g., an enhanced response to nociceptive stimuli may lead to hyperalgesia). An enhanced internal response to external stimuli is often observed in people with autism spectrum disorders (Grant et al., 2022). Diseases characterized by CS, such as CFS, are more frequently observed in people with ASD (Ablin et al., 2016).

Conclusions

The pandemic caused by the SARS-CoV-2 virus was a difficult period for most people with ASD, who showed increased emotional and behavioral problems that persisted after the pandemic ended. Based on the literature review, it can be concluded that COVID-19 has a significant impact on neuropsychiatric symptoms in people with autism spectrum disorders. Difficulties in the treatment of long COVID in patients with ASD have been observed. There is a need to increase the awareness of parents, health care workers, and scientists about the effects of SARS-CoV-2 infection in the population of people with autism spectrum disorders. This is necessary to understand the consequences of the disease, speed up diagnosis and provide appropriate specialist help.

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