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REPORT CARD



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In November 2019 in the city of Wuhan, an atypical lung infection was identified. On 2019/12/31, the World Health Organization (WHO) was alerted to several cases of pneumonia in the city. And, on 2020/01/07, Chinese authorities confirmed that they had identified a new type of coronavirus - 2019-nCoV. On 2020/01/30 the WHO declared an outbreak of the new coronavirus, classifying it as a

**Public Health
Emergency of
International
Importance (PHEII).**



On 2020/03/11 the disease Covid-19 was characterized by the WHO as a pandemic. After more than

237 million infections

and more than 4.8 million deaths worldwide, the pandemic is now in regression thanks to worldwide mass vaccination. However, after some 2 years of this sad reality, in addition to people still being infected, there is now the need to deal with the impacts on people who have recovered and survived, effects which can either be transitory or persistent. Covid-19 has brought moments of isolation and people have had to readapt their economic, physical, and psychological conditions. Covid-19 has brought great challenges to mental health and cognitive function.

One potential problem is that a person's worry and fear seem to have a negative effect on their attentional processes.



The pandemic has given rise to several anxiety and depression conditions that, in some cases, have resulted in damage to areas of the brain that regulate cognition and attention. Such losses have meant that schools have needed to make several changes in teaching methods in order to deal with the problem.

The greatest impairments seem to be related to executive functions, which include difficulties in control of attention, in planning, abstraction, behavior, decision-making, and cognition.

It is not uncommon for patients to visit our offices who have recovered from Covid-19 but still have some type of forgetfulness, mental confusion, or slowness in reasoning, and these cases strengthen the idea that attentional and cognitive impairments may be an after-effect of Covid-19 infection. An interesting study carried out in the United Kingdom on 80,000 individuals who were affected with Covid-19 reported difficulties in reasoning, problem solving, and cognitive tasks. The researchers observed that patients who had suffered more severe forms of the disease, and who had



needed respiratory intervention such as the use of a mechanical ventilator, presented greater losses in attentional processes compared to patients who had had milder versions of the illness.

The invasion of the central nervous system by SARS-CoV 2 is not well understood, but we do know

that the virus has an affinity for angiotensinogen-converting enzyme 2 (ACE-2) receptors. Such receptors are present in many systems, including the capillary endothelium of all vessels. ACE-2 receptors are expressed in the CNS in oligodendrocytes, astrocytes, and neurons, and can be detected

in the substantia nigra, ventricles, middle temporal gyrus, posterior cingulate, and olfactory bulb. As with previous epidemics caused by coronavirus, cases of encephalitis caused by the virus itself are rare, with pathology of fatalities showing effects mainly in the brainstem. The cognitive changes observed in patients with Covid-19 are mainly due to the following factors:

- **Hypoxia: secondary to chronic or intermittent hypoxia;**
- **Septic/infectious: secondary to cytokine-mediated brain damage due to microglial activation;**
- **Metabolic: secondary to kidney or liver dysfunction; and**
- **Sedative: secondary to the use of drugs in intensive care.**



An interesting case report illustrates the effect of attention from Covid-19. A young health care professional noticed persistent difficulty maintaining attention while driving his car. He did not have fatigue or excessive workload or been involved in any recent traumatic event. Following the difficulty noted in driving, he developed fever, ageusia, and anosmia and was admitted to

hospital. Tests proved positive for SARS-CoV-2. During his entire stay in hospital, he continued to complain of attention deficits, and was monitored by qualified professionals. A Continuous Visual Attention Test on the third day of hospitalization found a moderate impairment of attention, while on the sixth day a marked deterioration in attention was observed. Some 8 hours after this worsening of the care picture, impairment of respiration and a drop in oxygen saturation were seen.

This case report corroborates other studies that associate attention deficits with worsening of respiratory function.



When attempting to measure attention objectively, there are different approaches that can be used. However, within the field of audiology, one of the best known and well-used technique is electrophysiological assessment of the P300 cognitive potential. The P300 is considered to reflect cognitive processes such as the updating of working memory and the transfer of information to consciousness.

The P300 cognitive potential can be used to assess and monitor patients affected by Covid-19 and who present with complaints of attentional impairment. The P300 can analyze auditory and attentional function in different situations and clinical populations. With it, one can observe the neurophysiological substrate of cortical processes related to cognition, such as:

- **Memory;**
- **Attention;**
- **Sequential processing of auditory information;**
- **Decision making;**
- **Auditory discrimination;**
- **Sustained attention.**

To assess the P300 cognitive potential, the patient is instructed to pay attention only to a randomly presented infrequent (rare) stimulus among a constant stream of auditory stimuli, and respond positively (say with a button push) every time they hear this stimulus. In addition, it is recommended that the patient be instructed to mentally count these rare sound stimuli. When the patient pays attention to the sound stimuli and responds appropriately, one usually finds an electrical wave with a positive peak of at least 3 microvolts and latency of around 300 milliseconds. Latency values are different for different age groups.

In our clinic, a 52-year-old adult male patient, referred to here as AYZ, came to our service complaining of inattention following Covid-19 infection.

Throughout treatment, the patient observed the following complaints of attentional impairment:

- **difficulties in remembering city names;**
- **difficulties in remembering people's names;**
- **difficulties in keeping attention on TV series;**
- **difficulties in keeping attention when reading books.**



According to the patient's report, attention deficits appeared about 12 hours before the onset of the first physical symptoms and before he sought specialized care and confirmation of Covid-19 infection.



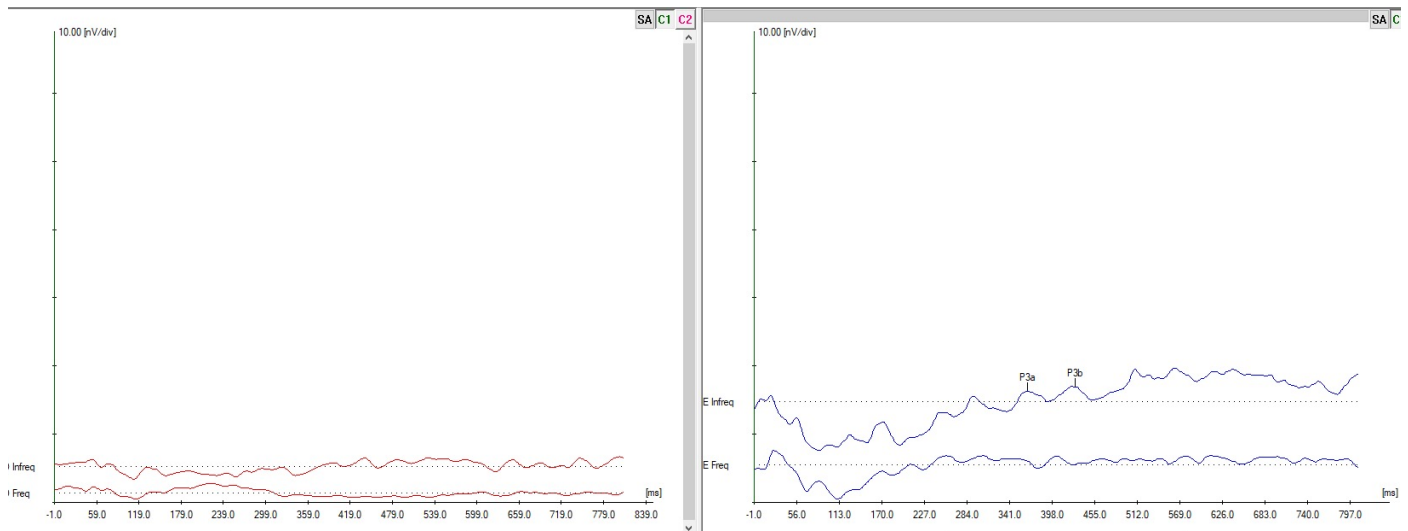


Figure 1 – – Cognitive potential responses (P300) of patient AYZ (red, right ear; blue, left ear)

After treatment for Covid-19, the patient returned to his daily activities but the attention deficits remained. After otorhinolaryngological evaluation, he was referred for audiological and electrophysiological evaluation, presenting the following results:

- pure tone and vocal audiometry with responses within normal limits in both ears;
- integrity of the auditory pathway through the Brainstem Auditory Evoked Potential with responses within normal limits in both ears.

Subsequently, AYZ was referred for neurological evaluation, being asked, among other tests, to perform the P300 test. The P300 results showed a lack of response in the right ear associated with a prolongation in the P300b wave latency values (428 milliseconds) and a decrease in neuronal activity

identified by a P300b wave of reduced amplitude values (<3.0 microvolts) in the left ear (see Figure 1).

As these studies illustrate, there is significant evidence in the scientific literature of an association between attentional impairment and Covid-19. However, specifically regarding the P300 cognitive potential in Covid-19, there is still a lot to be discovered. In addition, as Covid-19 is a relatively new disease, most studies are case studies. There is a need for studies involving a larger number of individuals and which focus on central auditory pathways through measurement of Long Latency Auditory Evoked Potentials (specifically, the P300). The aim should be to verify the integrity of the auditory pathway and the involvement of attentional and cognitive aspects, since both

may be compromised during and after Covid-19 infection. This bulletin will continue to alert you to new possibilities for studies and mention useful and beneficial ways of monitoring patients. Until our next newsletter!

Consulted References:

1) Hampshire A, Trender W, Chamberlain SR, Jolly AE, Grant JE, Patrick F, et al. Cognitive deficits in people who have recovered from COVID-19. *EClinicalMedicine*. 2021. DOI: 10.1016/j.eclinm.2021.101044.

2) Sanfins MD, Mecca FFN, Skarzynski PH. Learning difficulties in times of a corona virus pandemic. *Cena News*. 2021. DOI:10.13140/RG.2.2.11034.98244 - vol 20.

3) Lahiri D., Ardila A. COVID-19 pandemic: a neurological perspective. *Cureus*. 2020;12(4).

4) Helms J., Kremer S., Merdji H., Clere-Jehl R., Schenck M., Kummerlen C. Neurologic features in severe SARS-CoV-2 infection. *N Engl J Med*. 2020;382(23):2268-2270.

5) Tolentino JC, Gjorup ALT,

Schmidt GJ, Schmidt SL. Early attention impairment in a patient with COVID-19. *Psychiatry Clin. Neurosci.*, 75: 66-67. <https://doi.org/10.1111/pcn.13178>.

6) Sanfins MD, Matas CG. Potencial evocado auditivo de longa latência (PEALL): Potencial Cognitivo (P300). In: Menezes PL, Sanfins MD, Capra D, Andrade KCL de, Frizzo, ACF (eds). *Manual de Eletrofisiologia e Eletroacústicas: um guia para clínicos*, Ribeirão Preto: Booktoy, 2021; 251-262

7) Ramage A E. Potential for Cognitive Communication Impairment in COVID-19 Survivors: A Call to Action for Speech-Language Pathologists; *American Journal of Speech-Language Pathology* 2020 - 29(4): 1821-1832. https://doi.org/10.1044/2020_AJSLP-20-00147.

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