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Contribution of Metabolic Imaging in the Exploration of Cognitive Disorders Related to COVID-19

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Abstract

On March 11, 2019, the WHO declared COVID-19 a pandemic disease. It is a respiratory tropism SARS COV 2 infection. In the emergency of the pandemic, in medical imaging, only computed tomography (CT) of the lungs was favored to assess lung lesions. In addition, many cases of post-COVID-19 cognitive disorders have been reported. As the curve dips and services restart correctly, other imaging techniques have been used to better explore the disease. The objective of this presentation is to illustrate the contribution of metabolic imaging in the exploration of post COVID-19 cognitive disorders and to discuss the pathophysiological mechanisms. Hypometabolism brain lesions are objective signs of functional impairment whose pathophysiological mechanism is not yet fully understood. Metabolic imaging with PET-SCAN is a suitable tool for exploring these disorders, both for the severity and extent of the lesions and for the topography of the brain damage.

Keywords

COVID-19, Nuclear Medicine, Cognitive Disorders, PET-SCAN

1. Introduction

On March 11, 2019, the WHO declared COVID-19 a pandemic disease. It is a respiratory tropism SARS COV 2 infection. In the emergency of the pandemic, in medical imaging, only computed tomography (CT) of the lungs was favored to assess lung lesions. In addition, many cases of post-COVID-19 cognitive disorders have been reported. As the curve dips and services restart correctly, other

imaging techniques have been used to better explore the disease. The objective of this presentation is to illustrate through two clinical cases the contribution of metabolic imaging in the exploration of post COVID-19 cognitive disorders and to discuss the pathophysiological mechanisms.

2. Methodology

We have selected 02 illustrative cases of patients who present post-COVID-19 cognitive disorders and explored by positron emission tomography (PET) after:

- Normal glycemic control.
- Acquisition centered on the skull after injection of 18 F-FDG and realization of an X-ray scanner for attenuation correction and anatomical location.

3. Results

CASE 1:

54-year-old patient with no reported pathological history who presented with post-COVID-19 cognitive disorders in whom 18-FDG-PET exploration showed hypofixation in the precuneus and bilateral-internal-temporal cortex (Figure 1).

CASE 2:

51-year-old patient with no reported pathological history who presented with post-COVID-19 cognitive disorders in whom 18FDG-PET exploration showed frank hypofixation in the precuneus and posterior cingulum and more discreet hypofixation in the frontal cortex mesial and temporal-internal-bilateral cortex (Figure 2).

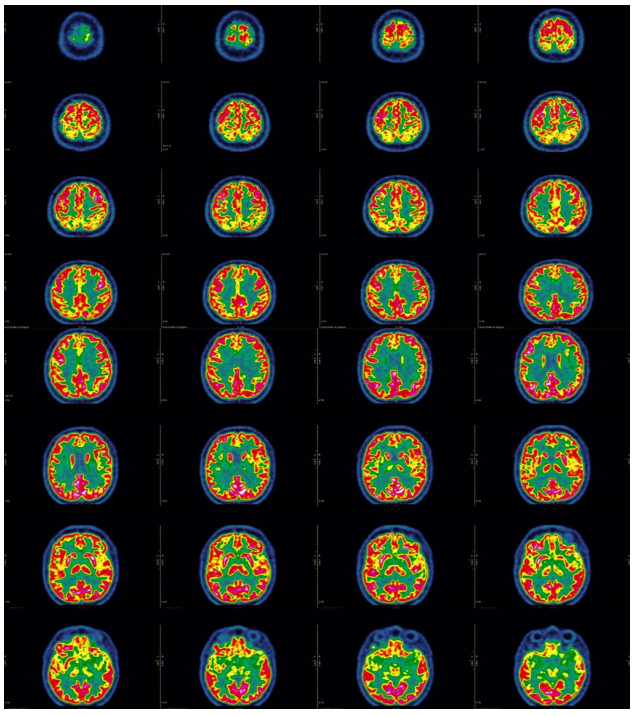

Figure 1. Diffuse hypofixation predominant in the precuneus and bilateral-internal-temporal cortex.

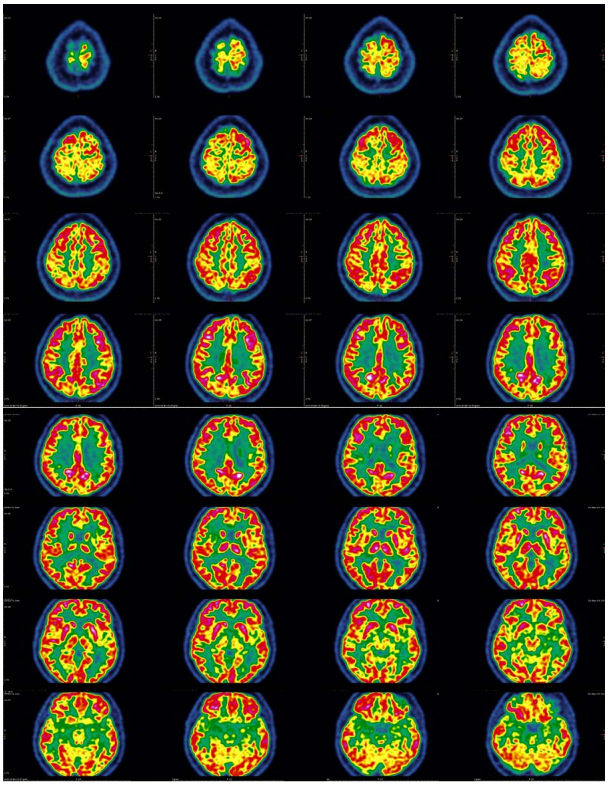

Figure 2. Clear hypofixation of the precuneus and posterior cingulum and a more discreet hypofixation in the frontal and bilateral-internal temporal cortex.

4. Discussion

Metabolic imaging has made it possible to objectify lesions of cerebral hypometabolism post-COVID-19; objective signs of functional impairment whose pathophysiological mechanism is not yet fully understood. In addition to the inflammation genesis of neuropsychological sequelae, hypotheses of systemic endothelial lesions and neurotropism of SARS COV 2 have been mentioned [1]. It is accepted that COVID-19 causes systemic disorders with a polymorphism of central nervous system damage. These attacks of the central nervous system are also manifested by headaches, nausea, drowsiness and encephalopathy with agitation or confusion. In addition, in a French observational study, involving 58 COVID-19 patients with neurological impairment, magnetic resonance imaging (MRI) found, in some of them, meningeal involvement (60% of patients) and cerebral perfusion disorders (84% of patients) [2]. Also, a study carried out in China on the incidence of cognitive disorders in survivors of COVID-19 after 12 months of the acute phase confirms the high risk of cognitive decline in patients aged ≥ 60 years. The increased risk correlates with the severity of the disease. It can reach 12.45% of cases of COVID-19 [3]. However, the occurrence of cognitive disorders in serious respiratory diseases is not a new fact [4].

The topography of hypometabolism in the cases we present is compatible with the cognitive disorders observed. Remember that the temporal lobe plays a role in cognitive processes. Particularly in the processing of auditory information, the

processing of visual information, which takes place in the temporal cortex and the storage of information as well as emotional experience [5] [6]. Also, the posterior cingulate cotext is involved in recall and in topographical orientation [7]. The frontal lobe is primarily involved in planning, decision-making and reasoning [8].

A multicenter study focused on cerebral hypometabolism detected by 18 F-FDG PET-SCAN in patients suspected of long-term covid and presenting with neurological damage. It confirms the potential of metabolic imaging in the assessment of the severity of hypometabolism and the topographic diagnosis of brain damage [9].

5. Conclusion

Hypometabolism brain lesions are objective signs of functional impairment whose pathophysiological mechanism is not yet fully understood. In addition to the inflammation genesis of neuropsychological sequelae, the hypotheses of systemic endothelial lesions and neurotropism of SARS COV 2 have been mentioned. This is a vast field in which molecular imaging can occupy a prominent place. Metabolic imaging with PET-SCAN is a suitable tool for exploring these disorders, both for the severity and extent of the lesions and for the topography of the brain damage.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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