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EDITORIAL

Metabolic brain function

Función metabolica del cerebro

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We all know that our brain requires oxygen and glucose to carry out the biochemical processes necessary for it to function, as it needs more energy than any other organ in the body. The average cerebral blood flow is 50 mL/100 g/min to ensure an average oxygen consumption at rest of 3.5 mL/100 g/min[1]. Glucose is the principal source of energy for the brain; however, it does not cross the blood–brain barrier freely. To enter the brain, it requires an active transport mechanism through the Glucose transporter 1[1,2].

The role of glucose in the brain has been known for a century. Variations in glucose levels cause changes in alertness; patients with hypoglycemia experience drowsiness, leading to stupor or coma if this decrease in glucose is persistent. The changes observed confirm the importance of glucose as fuel for the brain[2]. In this edition, Jiménez-Maldonado et al. report early signs of metabolic dysfunction in the brains of young adults with type 1 diabetes mellitus (DM1).

Glucose levels in the brain correspond to 10-25% of plasma levels, so there are variations after eating foods with hyperglycemia spikes and during fasting with hypoglycemia[3]. Variability in glucose levels can lead to long-term complications, such as cognitive complications[4]. In patients with DM1 and elderly patients with DM2, alterations associated with information processing speed, verbal fluency, attention, and memory have been identified[5].

In their study, Jiménez-Maldonado et al. evaluated verbal fluency using blood oxygen level-dependent signaling in functional magnetic resonance imaging in subjects with DM1 compared to healthy controls. Although they found no differences in cognitive assessment, they did find that patients with DM1 required the activation of larger brain areas, including subcortical regions such as the basal ganglia, to perform the tasks.

DM1 is most frequently diagnosed during childhood and adolescence, when changes in the central nervous system are taking place, meaning that variations in glucose levels can have repercussions. Acute hypoglycemia causes global cognitive impairments such as short-term memory loss. If hypoglycemia is severe, it can cause irreversible neurological damage due to diffuse necrosis of the cortex, or even death. Acute hyperglycemia can also cause impairments such as bradypsychia and inattention[6].

Therefore, it is important that patients receive adequate treatment and avoid extreme and non-physiological variability in glucose levels. The measurement of glycosylated hemoglobin (HbA1c) values has been used as an indicator of the degree of glucose control[7].

Diabetes continues to be a global health problem. In Mexico, the prevalence of diabetes in 2022 was 18.3%, occurring at older ages and among people with lower levels of education. Of all cases of diabetes, type 2 diabetes accounts for 90-95% of cases, and type 1 diabetes accounts for 5-10%[8]. Due to the high prevalence of DM2 in the population, cognitive impairments should be sought in this group of patients, and not only in patients with DM 1.

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As medical professionals, we recognize the association between diabetes and the presence of cardiovascular and cerebrovascular disease, kidney disease, and amputations. However, we must integrate the presence of cognitive impairment into the study protocol for patients with diabetes, using screening tests such as the Mini-Mental or the MoCA test, as well as more specific tests through neuropsychological assessment.

In conclusion, diabetes can interfere with the brain's metabolic function, which can lead to cognitive impairment. Therefore, we must prevent its onset by adequately controlling glucose levels through optimized treatment.

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