# Editorial for "Diffusion Tensor Imaging Reveals Altered Topological Efficiency of Structural Networks in Type-2 Diabetes Patients With and Without Mild Cognitive Impairment"

Type 2 diabetes mellitus (T2DM) is the most frequent category of diabetes, consisting of a chronic metabolic disease in a response for the deficit in insulin secretion and/or action, which results in hyperglycemia[1] and in long term is associated with the dysfunction of several organs such as kidney, heart, eyes, and the vascular system. These dysfunctions and failures are enhanced by coexisting comorbidities, including obesity, hypertension, and dyslipidemia.[2] The severity of T2DM increases when it affects the vascular system, with the flow reaching its final target in the cerebrovascular and brain tissues.

While hyperglycemia and glucose intolerance are the main manifestation for T2DM patients, the neurological impact of type 2 diabetes, whose main outcome is the cognitive impairment,[3] is also an important condition for these patients. Although evaluating the direct impact of T2DM in the occurrence of cognitive impairment is hampered due to the coexisting cerebrovascular diseases, emerging evidence are being carried out to elucidate the relationship between T2DM and cognitive impairment, which may increase the risk of developing dementia.[4]

Neuroimaging studies arise as an important field in the understanding of the pathways, mechanisms, and the preferred target regions in the brain that are related to the development of cognitive impairment. In especial, magnetic resonance imaging provides a set of tools to investigate the alterations in the T2DM patient's brain. Among all the methods available, structural analysis of volumetry and cortical thickness,[5] functional integration,[6] and metabolic evaluation[7] has already resulted in alterations when compared to healthy subjects. Furthermore, diffusion-weighted imaging has been well explored to evaluate the macro and microstructural integrity of white matter (WM) for specific regions and brain topology.[8,9] However, there is still lacking a deeper understanding on the specific brain organization in T2DM that differs from patients with and without cognitive impairment.

In this issue of *JMRI*, Xiong et al assessed the differences between T2DM patients with and without mild cognitive impairment (MCI) regarding the alterations in WM network topology at global and nodal levels.[10] The network topological study was based on the use of diffusion-weighted images to perform a deterministic tractography and graph theory analysis followed by the appropriate statistical analysis to identify the differences between the two target groups of T2DM patients. For the regions that resulted in differences between the groups, they performed a correlation analysis to investigate the relationship between topological brain networks and traditional markers for diabetes severity.

Xiong et al revealed that T2DM-MCI patients presented more damaged global topological organization of WM than T2DM patients without MCI when compared to healthy subjects and decreased network efficiency when straight compared to T2DM without MCI. It was also reported that despite decreased nodal efficiency was found for both MCI and not-MCI T2DM patients in the frontal, parietal, temporal, and occipital cortices than in healthy controls, other regions showed decreased efficiency only for MCI-T2DM patients in comparison to healthy subjects, suggesting advanced disease stages for this group. In that sense, the outcomes of this study included the correlation of the severity of diabetes and reduced cognitive capacity to the alterations in several network parameters.

Finally, the authors suggested a possible early biomarker of cognitive impairment for T2DM patients by reporting reduced nodal efficiency in brain regions straight related to cognitive functions (posterior cingulate, insula, and the orbital part of the inferior frontal gyrus) for the group of diabetes patients with normal cognition

 

than the healthy control group. Although it represents promising results, there is still the need for a deeper investigation of these findings. Other limitation of the study is the comparison of MCI patients with and without T2DM, which might enlighten the cause/consequence relationship between cognitive impairment and severity of T2DM.

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**Level of Evidence:** 5
**Technical Efficacy:** Stage 2