

Longitudinal study of functional brain network reorganization in clinically isolated syndrome

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Background: There is a lack of longitudinal studies exploring the topological organization of functional brain networks at the early stages of multiple sclerosis (MS). The present study aims to assess potential brain functional reorganization at rest in patients with CIS (PwCIS) after one year of evolution and to characterize the dynamics of functional brain networks at the early stage of the disease.

Methods: 41 PwCIS and 19 matched healthy controls (HC) were scanned at baseline and 1 year after the first assessment. Using graph theory, topological metrics were calculated for each region. Hub disruption index was computed for each metric.

Results: Hub disruption indexes of degree and betweenness centrality were significantly negative at baseline in patients ($p < 0.001$ and $p < 0.05$, respectively), suggesting brain reorganization. After 1 year, hub disruption indexes for degree and betweenness centrality were still significantly negative ($p < 0.00001$), but such reorganization appeared more pronounced than at baseline. Different brain regions were driving these alterations. No global efficiency differences were observed between PwCIS and HC either at baseline or at 1 year.

Conclusion: This study showed, for the first time, dynamic changes in functional brain networks of patients in the early stage of MS. The pattern of functional connectivity reorganization remained the same during the first year after the CIS but tended to be more pronounced at one year. At the first stage of the disease, regional reorganization of connectivity is associated with the maintenance of normal global efficiency in the brain, suggesting a compensatory effect.