

# **The severity of chronic cerebrospinal venous insufficiency in patients with multiple sclerosis is related to altered cerebrospinal fluid dynamics**

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Chronic cerebrospinal venous insufficiency (CCSVI) is a vascular picture that shows a strong association with multiple sclerosis (MS). The aim of this study was to investigate the relationship between a Doppler cerebral venous hemodynamic insufficiency severity score (VHISS) and cerebrospinal fluid (CSF) flow dynamics in 16 patients presenting with CCSVI and relapsing-remitting MS (CCSVI-MS) and in eight healthy controls (HCs). The two groups (patients and controls) were evaluated using validated echo-Doppler and advanced 3T-MRI CSF flow measures. Compared with the HCs, the CCSVI-MS patients showed a significantly lower net CSF flow ( $p=0.027$ ) which was highly associated with the VHISS ( $r=0.8280$ ,  $r^2=0.6855$ ;  $p=0.0001$ ). This study demonstrates that venous outflow disturbances in the form of CCSVI significantly impact on CSF pathophysiology in patients with MS.