

Iron and veins in multiple sclerosis

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The hypothesis that multiple sclerosis (MS) might be related to venous pathology has been considered in the past. Recently, a condition called chronic cerebrospinal venous insufficiency (CCSVI) has been proposed and reported with high frequency in MS. CCSVI is described as a vascular condition characterized by anomalies of the main extracranial cerebrospinal venous routes that interfere with normal blood outflow of brain parenchyma in patients with MS. Thin, linear periventricular white matter (WM) lesions (Dawson's fingers) present in the initial stages of MS are often oriented around the long axis of central veins. Histopathological studies have confirmed the close relationship between inflammatory MS lesions and venous cerebral microvasculature, suggesting that the primary inflammatory process in MS regionalizes around blood vessels, with acute lesions showing lymphocytic perivascular infiltration, hypercellularity, macrophage infiltration and intra-macrophage myelin debris. Early MR venography studies suggest that a substantial number of MS lesions are crossed by well-defined central veins. 4 These findings have been confirmed and extended by recent ultra-high-field 7T MRI

studies which showed that a majority of MS lesions are associated with centrally coursing veins. Close examination revealed well defined central veins surrounded by subtle abnormalities in signal intensities in a strict perivenous fashion, with vascular wall involvement. Susceptibility-weighted imaging (SWI) venography can directly image cerebral veins using indirectly deoxyhemoglobin as an intrinsic contrast agent and, therefore, allows direct and non-invasive assessment of venous blood oxygenation saturation and visualization of the venous structures. SWI venography studies showed significantly reduced periventricular WM venous vasculature visibility (VWV) in MS patients as compared to healthy control (HC) subjects. Recent study showed that presence and severity of CCSVI is related to decreased brain parenchyma SWI VWV in patients with MS. In addition, the findings from recent studies suggest that CCSVI may be an important mechanism related to iron deposition in the brain parenchyma of MS patients.