Magnetic Resonance Imaging / Formation image de résonance magnétique

Prevalence of Extracranial Venous Narrowing on Magnetic Resonance Venography is Similar in People With Multiple Sclerosis, Their Siblings, and Unrelated Healthy Controls: A Blinded, Case-Control Study

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Abstract

Purpose: The study sought to assess and compare the prevalence of narrowing of the major extracranial veins in subjects with multiple sclerosis and controls, and to assess the sensitivity and specificity of magnetic resonance venography (MRV) for describing extracranial venous narrowing as it applies to the chronic cerebrospinal venous insufficiency theory, using catheter venography (CV) as the gold standard.

Methods: The jugular and azygos veins were assessed with time-of-flight MRV in this assessor-blinded, case-control study of subjects with multiple sclerosis, their unaffected siblings, and unrelated controls. The veins were evaluated by diameter and area, and compared with CV. Collateral vessels were also analyzed for maximal diameter, as a potential indicator of compensatory flow.

Results: A high prevalence of extracranial venous narrowing was demonstrated in all study groups, collectively up to 84% by diameter criteria and 90% by area, with no significant difference between the groups when assessed independently (P = .34 and .63, respectively). There was high interobserver variability in the reporting of vessel narrowing (kappa = 0.32), and poor vessel per vessel correlation between narrowing on MRV and CV (kappa = 0.064). Collateral neck veins demonstrated no convincing difference in maximum size or correlation with jugular narrowing.

Conclusion: There is a high prevalence of narrowing of the major extracranial veins on MRV in all 3 study groups, with no significant difference between them. These findings do not support the chronic cerebrospinal venous insufficiency theory. Although MRV has shown a high sensitivity for identifying venous narrowing, time-of-flight imaging demonstrates poor interobserver agreement and poor specificity when compared with the gold standard CV.
Multiple sclerosis (MS) is a common debilitating demyelinating neurodegenerative disorder. Prevalence averages 30 per 100,000 globally but with significant regional variability, with particularly high rates (as high as 176 per 100,000) in Canada, the United States, and Central Europe [1]. Although generally accepted as an inflammatory autoimmune process [2] with evidence of a genetic predisposition [3] and environmental or demographic influence [1], the underlying pathogenesis remains elusive. Although a spatial relationship between MS plaques and venous structures has long been described [2], more recently venous pathology as a potential initiator of the disease process [4,5] has been the topic of great interest and scrutiny. The chronic cerebrospinal venous insufficiency (CCSVI) theory, as proposed by Zamboni et al [5] in 2009, hypothesizes that extracranial venous blockages result in complex hemodynamic flow abnormalities within the intra and extracranial venous system. Specific patterns of venous stenosis and collateral drainage were described on duplex ultrasound and catheter venography (CV). The study [5] reported a definitive finding in all 65 patients with clinically diagnosed MS, universally absent in non-MS patients, a perfect association. Much research has been done subsequently [6], but the results of this original CCSVI study have yet to be reproduced.

This article is part of a 3-arm (subjects with MS, their healthy siblings, and unrelated healthy controls) multicenter prospective study designed to assess the validity of the CCSVI theory through 3 modalities, namely Doppler ultrasound, CV, and magnetic resonance venography (MRV). The Doppler ultrasound and CV findings were published previously [7]. No significant differences were found in the ultrasound findings between MS cases and study controls, and the ultrasound criteria for CCSVI were neither sensitive nor specific for venous narrowing identified on CV. Furthermore, CCSVI [5], involving multiple venous obstructive patterns in combination, was found to be a rarity (<3% of study cohort) on CV, with no significant difference between MS subjects and controls. Conversely, narrowing of any 1 major extracranial vein by >50% on CV was commonly described in both the MS and control groups, with no significant difference between them. Herein we report the findings of this multicenter study related to the extracranial venous anatomy imaged by MRV.

MRV has the advantage of being noninvasive compared with CV and less operator dependent than ultrasound imaging modalities. MRV also provides a large field of view, enabling visualization of the jugular and azygos veins, as well as potential collateral veins in the anterior and posterior neck. Although unenhanced 2-dimensional (2D) time-of-flight (TOF) acquisitions largely focus on anatomy, enhanced time-resolved acquisitions may have the ability to evaluate flow patterns as well. With all of the above attributes, MRV has the potential to be a screening tool for the specific venous obstructions proposed by the CCSVI theory [5]. However, to date, MRV studies have varied in their findings [8–19], and systematic definitions or consensus criteria for reporting venous narrowing on MRV have yet to be defined.
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