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A quantitative evaluation of extracranial venous flow as a biomarker of neurodegenerative disease

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MRI is a reliable method for quantifying blood flow and visualizing head and neck vasculature in 3D. Using high resolution 3D vascular imaging and 2D cardiac gated flow quantification, we will show that multiple sclerosis patients reveal anomalous venous behavior compared to healthy controls (HC). Our goal is to determine the optimum flow thresholds to differentiate normal flow from abnormal flow. A further computation fluid dynamic approach will be taken by Prof. Eleuterio Toro. More specifically, a group of 138 MS and 67 HC subjects were imaged on 3T Siemens scanners between two sites. Both 2D time-of-fligit MRV and 3D time resolved contrast enhanced MRAV were used to determine if internal jugular vein (IJV) stenosis was present, subdividing the MS patients into stenotic (ST) and non-stenotic (NST) groups. The 2D PC was used to quantify flow through the major arteries and IJVs at both C2 and C6 levels. The ratio between the larger IJV flow (dJ) versus the smaller IJV flow (sdJ) was calculated as sdJ/dJ. IJV flow was then normalized to the total arterial flow (tA), providing two major criteria for both levels, the tIJV/tA, where tIJV is the sum of both IJV flows, and sdJ/tA. Using a normalized flow cut-off of roughly 0.64, the subjects that fall below this threshold at both C2 and C6 for the tIJV/tA criteria are: 9% of HC, 11% of NST, and 61% of ST. In conclusion, the current sample of MS patients and HC indicates that there is a statistically significant difference in venous outflow through the IJV between the two groups and that a quantitative flow measure may prove to be a means to assess risk of developing MS.

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