From Stenoses to Fatigue and Scleroses

***Authors & Affiliation**: Trevor W Tucker, PhD*

President, Tactical Technologies Inc

Introduction: This paper hypothesizes that a stenosis or obstruction at a lower extremity of an internal jugular vein (IJV) would, in accordance with classical fluid mechanics, cause a standing pressure wave within the vein.

Materials & Methods:

The method is the application of classical fluid mechanics analysis to the hydraulic pressure distribution in an obstructed internal jugular vein. No materials have been used.

Results: The results are that the predicted standing wave gives rise to abnormally high back pressure fluctuations at the venule end of the capillary bed. This is predicted, in turn, to cause hypoperfusion in the cerebral capillary bed, fatigue and potentially sclerosis at the venule end of the bed.

Discussion & Conclusion: The predicted standing wave would possess a region of large pressure fluctuations at the lower end of the IJV near the blockage, another at or near the capillary bed's venule end of the vein and a third large fluctuation region near the middle of the vein. Approximately half way between each of these regions of large fluctuation are predicted to be regions of relatively little pressure fluctuation. Depending on the degree of obstruction or blockage in the vein the pressure fluctuations at the venules of the capillary bed may be nearly double those that would exist in a healthy unblocked vein. This increase in blood pressure at the venule end of the capillary bed is predicted to reduce the pressure drop across the bed which in turn is predicted to reduce blood flow through the bed in accordance with Darcy's Law. The reduced flow of blood is predicted to reduce the transfer of oxygen, glucose and other nutrients into the brain's grey and white matter in accordance with Fick's Principle. This reduction in nutrients, in turn, is predicted to contribute to decreased mental acuity and increased chronic fatigue.

In addition, the paper also predicts that, in extreme cases of blockage, the pressure fluctuations at the venule end of the capillary bed may be sufficient to exceed the linear region of Hooke's Law of Elasticity. This is predicted to lead to the potential rupture of vessels at the venule end of the capillary and their associated blood-brain barrier. Such a disruption of the blood-brain barrier may allow for the migration through the barrier of auto-immune attack cells, such as T-cells, enabling them to attack myelin sheaths (which may be unhealthy as a result of a deficient supply of oxygen). Such attacks are normally associated with the lesions and plaques of multiple sclerosis.

The paper predicts that clearing the obstruction at the valve end of the IJV would reduce fatigue and increase mental acuity.

References:

1. Zamboni P, et al, Chronic cerebrospinal venous insufficiency in patients with multiple sclerosis, J Neurol Neurosurg Psychiatry, 2009 April; 80(4), 392–399.
2. Zamboni P, et al, A prospective open-label study of endovascular treatment of chronic cerebrospinal venous insufficiency, Journal of Vascular Medicine, 2009, 50(5), 1348 – 1358.
3. Simka M, et al, Extracarial Doppler sonographic criteria of chronic cerebrospinal venous insufficiency in patients with multiple sclerosis, International Angiology, 2010, 29(2), 109 -14.
4. Zivadinov R, Combined transcranial and extracranial venous Doppler evaluation of multiple sclerosis and related diseases (CTEVD Study), Presented at the American Association of Neurologists Conference, Toronto, Canada, 2010.
5. Schelling A, Multiple sclerosis: the image and its message, ms-info.net, 2004.
6. Simka M, Blood brain barrier compromise with endothelial inflammation may lead to autoimmune loss of myelin during multiple sclerosis, Current Neurovascular Research, 2009 6 132 – 139.
7. Singh A, et al, Anomalous venous blood flow and iron deposition in multiple sclerosis, Journal of Cerebral Blood Flow and Metabolism, 2009, 29, 1867 – 1878.