

A theoretical study of the CCSVI condition

Lucas O. Müller and Eleuterio F. Toro, Università di Trento

Chronic Cerebrospinal Venous Insufficiency (CCSVI) is a recently described vascular condition characterized by anomalous intra and extra-cranial venous haemodynamics [2]. Here we present a theoretical study of the haemodynamical aspects of CCSVI by means of a closed-loop multi-scale model of the cardiovascular system. Systemic arteries and veins are described by a one-dimensional model, while the heart, capillary beds, pulmonary circulation and intracranial pressure are modelled with lumped parameter models. A novel aspect of this model is constituted by its detailed description of head and neck veins, which is extracted from MRI data and used to perform a patient-specific characterisation of the venous network [1]. We assess the impact of different CCSVI patterns in extra- and intracranial vessels and discuss the importance of specific physiological aspects in relation to the vulnerability of intracranial veins with respect to extracranial flow abnormalities. We conclude with some considerations on current/future research in CCSVI modelling, as well as on venous hemodynamics in general.

References

- [1] L. O. Müller and E. F. Toro. A global multiscale model for the human circulation with emphasis on the venous system. *International Journal for Numerical Methods in Biomedical Engineering*, 2013. In Press, preprint available at <http://www.newton.ac.uk/preprints/NI13007.pdf>.
- [2] P. Zamboni, R. Galeotti, E. Menegatti, A. M. Malagoni, G. Tacconi, S. Dall'Ara, I. Bartolomei, and F. Salvi. Chronic cerebrospinal venous insufficiency in patients with multiple sclerosis. *Journal of Neurology, Neurosurgery and Psychiatry*, 80:392–399, 2009.