



LEEDS  
BECKETT  
UNIVERSITY

---

Citation:

Beggs, CB and Magnano, C and Belov, P and Krawiecki, J and Ramasamy, DP and Hagemeyer, J and Zivadinov, R (2015) Internal jugular vein cross-sectional area and cerebrospinal fluid pulsatility in the aqueduct of Sylvius. In: 5th Annual meeting of the International Society for Neurovascular Disease, 27 - 28 March 2015, Naples, Italy.

Link to Leeds Beckett Repository record:

<https://eprints.leedsbeckett.ac.uk/id/eprint/2672/>

Document Version:

Conference or Workshop Item (Accepted Version)

---

The aim of the Leeds Beckett Repository is to provide open access to our research, as required by funder policies and permitted by publishers and copyright law.

The Leeds Beckett repository holds a wide range of publications, each of which has been checked for copyright and the relevant embargo period has been applied by the Research Services team.

We operate on a standard take-down policy. If you are the author or publisher of an output and you would like it removed from the repository, please [contact us](#) and we will investigate on a case-by-case basis.

Each thesis in the repository has been cleared where necessary by the author for third party copyright. If you would like a thesis to be removed from the repository or believe there is an issue with copyright, please contact us on [openaccess@leedsbeckett.ac.uk](mailto:openaccess@leedsbeckett.ac.uk) and we will investigate on a case-by-case basis.

# Internal jugular vein cross-sectional area and cerebrospinal fluid pulsatility in the aqueduct of Sylvius

Clive B. Beggs<sup>1,2</sup>, Christopher Magnano<sup>2,3</sup>, Pavel Belov<sup>2</sup>, Jacqueline Krawiecki<sup>2</sup>, Deepa P. Ramasamy<sup>2,3</sup>, Jesper Hagemeyer<sup>2</sup>, Robert Zivadinov<sup>2,3</sup>

1 Centre for Infection Control and Biophysics, University of Bradford, Richmond Road, Bradford BD7 1DP, UK;

2 Buffalo Neuroimaging Analysis Center, Department of Neurology, School of Medicine and Biomedical Sciences, University at Buffalo, 100 High St., Buffalo, NY 14203, NY, USA;

3 MRI Clinical Translational Research Center, School of Medicine and Biomedical Sciences, University at Buffalo, Buffalo, NY, USA

**Background:** Constricted cerebral venous outflow has been linked with increased aqueductal CSF pulsatility in healthy individuals [1] and MS patients [2]. However, the relationship between the CSF pulsatility and internal jugular vein (IJV) cross-sectional area (CSA) is unknown.

**Objective:** To characterise links between IJV CSA and aqueductal CSF pulsatility in MS patients and healthy subjects.

**Methods:** 98 relapsing-remitting MS patients (62 males and 36 females; mean age=44.2 years) and 99 healthy controls (48 males and 51 females; mean age=43.9 years) were investigated. CSF flow quantification involved cine phase-contrast MRI, while IJV CSA was calculated using magnetic resonance venography. Cardiovascular risk factor data were collected. Statistical analysis involved correlation, and partial least squares correlation (PLSC), analysis [3].

**Results:** For healthy controls, PLSC revealed a significant relationship ( $p=0.001$ ) between CSF pulsatility and IJV CSA in the lower neck (C5-C7), and a trend for this relationship ( $p=0.091$ ) at C2-C4. PLSC revealed no relationships in MS patients. After controlling for age and cardiovascular risk factors, many significant correlations were identified in the healthy controls between the CSF and IJV variables [e.g. net positive CSF flow and left IJV CSA at: C7-T1 ( $r=0.416$ ,  $p=0.002$ ) and C5-C6 ( $r=0.389$ ,  $p=0.003$ ); and net negative CSF flow and left IJV CSA at: C7-T1 ( $r=-0.352$ ,  $p=0.008$ ) and C5-C6 ( $r=-0.349$ ,  $p=0.009$ )], whereas there were only two significant correlations in MS patients [i.e. net positive CSF flow and right IJV CSA at: C5-C6 ( $r=0.311$ ,  $p=0.035$ ) and C4 ( $r=0.298$ ,  $p=0.047$ )].

**Conclusions:** In healthy adults, higher aqueductal CSF pulsatility is correlated with increased IJV CSA (particularly in the lower neck) in a relationship independent of age and cardiovascular risk factors. This relationship is largely absent in MS patients. Given CSF pulsatility and venous drainage are linked in healthy individuals [1], it may be that increased IJV CSA is indicative of stasis in venous outflow.

(Word count = 300 words)

## References:

1. Beggs CB, et al. Aqueductal cerebrospinal fluid pulsatility in healthy individuals is affected by impaired cerebral venous outflow. *Journal of Magnetic Resonance Imaging*. 2014. 40: 1215-1222
2. Zamboni P, et al. The severity of chronic cerebrospinal venous insufficiency in patients with multiple sclerosis is related to altered cerebrospinal fluid dynamics. *Funct Neurol*. 2009. 24: 133-138
3. McIntosh AR, Misic B. Multivariate statistical analysis for neuroimaging data. *Annu. Rev. Psychol*. 2013. 64: 499-525