

Jugular Venous Reflux and Neurological Disorders

Hung-Yi Hsu

Acta Neurol Taiwan 2011;20:1-3

Usually, disturbance of arterial blood supply and circulation of cerebrospinal fluid are considered more clinically relevant, though accumulating data suggest that cerebral venous insufficiency does have important pathophysiological consequences in various neurological diseases⁽¹⁻⁵⁾. Hindrance of principal and collateral cerebral venous outflow will cause elevation of venous pressure, insufficiency of cerebral blood flow (CBF), increase of intracranial pressure, and eventually lead to parenchymal abnormalities. Disorders involving cerebral venous circulation, such as cerebral sinus thrombosis, dural arteriovenous fistula, and surgical sacrifice of the cerebral veins, may lead to serious complications. However, most physicians do not assign practical importance to cerebral venous circulation.

Internal jugular vein (IJV) is a main extracranial route for cerebral venous drainage. The jugular venous valves, which are located near the junction with the innominate vein, prevent the transmission of thoracic pressure and the reflux of venous blood into the cerebral circulation. Jugular valve insufficiency could result in retrograde jugular venous flow and back transmission of central venous pressure. Previous studies have found significant associations between jugular venous reflux (JVR) and neurological disorders including transient global amnesia⁽¹⁾, transient monocular blindness⁽²⁾, multiple sclerosis⁽³⁾, exertional headache⁽⁴⁾, and idiopathic

intracranial hypertension⁽⁶⁾. Investigators from Taiwan contributed a lot to current understanding in the cerebral venous circulation^(1,2,7-9). However, there are some conceptual and technical limitations that challenge the relationship between JVR and clinical symptoms. Moreover, the association between JVR and neurological diseases can not be translated directly into a causal relationship.

In this issue, Chung et al. demonstrate that JVR influences cerebral blood flow while performing a Valsalva maneuver in their study⁽¹⁰⁾. This study gives direct evidence that supports the effect of JVR on CBF. This finding provides supplementary information to their previous works concerning the relationship between JVR and neurological disorders, and also raises some questions.

The main venous drainage routes vary with aging and are different among individuals^(11,12). The extent and distribution of reduced cerebral perfusion resulting from right and left JVR could be different. The right JVR had a greater influence on CBF compared with left JVR in current study⁽¹⁰⁾. In contrast, JVR occurred more frequently on left side in their previous study⁽¹⁾. The inconsistent findings may result from variations in the anatomic configuration of cerebral venous system, study population, and the capacity of collateral circles for drainage. Besides, the IJV may collapse and blood is

From the Section of Neurology, Department of Internal Medicine, Tungs' Taichung Metro Harbor Hospital, Wuci Township; and the Department of Neurology, School of Medicine, Chung Shan Medical University, Taichung, Taiwan. Accepted March 4, 2011.

Correspondence to: Dr. Hung-Yi Hsu, Department of Neurology, Tungs' Taichung Metro Harbor Hospital, No. 699, Sec. 1, Jhongci Road, Wuci Township, Taichung County 435, Taiwan, R.O.C. Fax: +886-4-26582193. Tel: +886-9-10597960. E-mail: hungyihsu@gmail.com

shunted to an alternative venous pathway in standing position in which most neurological symptoms occurs⁽¹³⁾. The influence of JVR on CBF in standing position has not been well evaluated. Some authors suggested a postural element was involved in the pathophysiology of cerebral venous insufficiency⁽¹⁴⁾. Factors that determining the greater influence of JVR on CBF need further studies.

Methods for diagnosing JVR vary in different studies. There is no consensus in quantification and diagnosis of cerebral venous insufficiency currently. Magnetic resonance venography (MRV) is able to demonstrate the extent of intracranial venous reflux and related parenchymal lesion(s). However, recent study showed that MRV had limited value for diagnosis of chronic cerebrospinal venous insufficiency in patients with multiple sclerosis⁽¹⁵⁾. Noninvasive sonography has good sensitivity and specificity in detecting cerebral venous insufficiency^(3,15,16). In addition, sonography has the advantage in evaluation of dynamic flow changes during various physiological challenges, notably Valsalva maneuver. Sonography is a good tool for the detection of cerebral venous insufficiency and JVR in experienced hands. The use of ultrasound contrast and respiratory maneuvers could be helpful in diagnosing cerebral venous insufficiency, but not essential. Selective venography helps to determine the location of venous stenosis/occlusion and to measure the venous pressure directly. Furthermore, endovascular treatment has been reported effective in relieving intracranial hypertension and improving neurological function in some multiple sclerosis patients⁽¹⁷⁾. Still, extrapolating the benefit of intravenous interventions should be cautious because there is no randomized trial yet^(18,19).

Current understanding of cerebral venous disorders is imperfect. Clinical evaluation of cerebral venous circulation is somewhat difficulty because variation in the anatomic configuration of cerebral venous system is a rule. Although the pathogenetic role of JVR needs more evidence to prove, cerebral venous insufficiency could be a neglected and treatable cause of some neurological disorders. Further studies may be needed to provide more insight into JVR and its potential relationship with

neurological disorders.

REFERENCES

1. Chung CP, Hsu HY, Chao AC, Chang FC, Sheng WY, Hu HH. Detection of intracranial venous reflux in patients of transient global amnesia. *Neurology* 2006;66:1873-1877.
2. Hsu HY, Chao AC, Chen YY, Yang FY, Chung CP, Sheng WY, Yen MY, Hu HH. Reflux of jugular and retrobulbar venous flow in transient monocular blindness. *Ann Neurol* 2008;63:247-253.
3. Zamboni P, Galeotti R, Menegatti E, Malagoni AM, Tacconi G, Dall'Ara S, Bartolomei I, Salvi F. Chronic cerebrospinal venous insufficiency in patients with multiple sclerosis. *J Neurol Neurosurg Psychiatry* 2009;80:392-399.
4. Doepp F, Valdueza JM, Schreiber SJ. Incompetence of internal jugular valve in patients with primary exertional headache: a risk factor? *Cephalalgia* 2008;28:182-185.
5. Cejas C, Cisneros LF, Lagos R, Zuk C, Ameriso SF. Internal jugular vein valve incompetence is highly prevalent in transient global amnesia. *Stroke* 2010;41:67-71.
6. Nedelmann M, Kaps M, Mueller-Forell W. Venous obstruction and jugular valve insufficiency in idiopathic intracranial hypertension. *J Neurol* 2009;256:964-969.
7. Chung CP, Hsu HY, Chao AC, Sheng WY, Soong BW, Hu HH. Transient global amnesia: cerebral venous outflow impairment-insight from the abnormal flow patterns of the internal jugular vein. *Ultrasound Med Biol* 2007;33:1727-1735.
8. Chung CP, Hu HH. Pathogenesis of leukoaraiosis: role of jugular venous reflux. *Med Hypotheses* 2010;75:85-90.
9. Chung CP, Hsu HY, Chao AC, Wong WJ, Sheng WY, Hu HH. Flow volume in the jugular vein and related hemodynamics in the branches of the jugular vein. *Ultrasound Med Biol* 2007;33:500-505.
10. Wu IH, Sheng WY, Hu HH, Chung CP. Jugular Venous Reflux Could Influence Cerebral Blood Flow: A Transcranial Doppler Study. *Acta Neurol Taiwan* 2011.
11. Doepp F, Schreiber SJ, von Munster T, Rademacher J, Klingebiel R, Valdueza JM. How does the blood leave the brain? A systematic ultrasound analysis of cerebral venous drainage patterns. *Neuroradiology* 2004;46:565-570.
12. Chung CP, Lin YJ, Chao AC, Lin SJ, Chen YY, Wang YJ,

- Hu HH. Jugular venous hemodynamic changes with aging. *Ultrasound Med Biol* 2010;36:1776-1782.
13. Gisolf J, van Lieshout JJ, van Heusden K, Pott F, Stok WJ, Karmaker JM. Human cerebral venous outflow pathway depends on posture and central venous pressure. *J Physiol* 2004;560:317-327.
 14. Beggs C. Multiple sclerosis appears to be associated with cerebral venous abnormalities. *Ann Neurol* 2010;68:560-561; author reply 561-562.
 15. Hojnacki D, Zamboni P, Lopez-Soriano A, Galleotti R, Menegatti E, Weinstock-Guttman B, Schirda C, Magnano C, Malagoni AM, Kennedy C, Bartolomei I, Salvi F, Zivadinov R. Use of neck magnetic resonance venography, Doppler sonography and selective venography for diagnosis of chronic cerebrospinal venous insufficiency: a pilot study in multiple sclerosis patients and healthy controls. *Int Angiol* 2010;29:127-139.
 16. Hojnacki D, Zamboni P, Lopez-Soriano A, Galleotti R, Menegatti E, Weinstock-Guttman B, Schirda C, Magnano C, Malagoni AM, Kennedy C, Bartolomei I, Salvi F, Zivadinov R. Use of neck magnetic resonance venography, Doppler sonography and selective venography for diagnosis of chronic cerebrospinal venous insufficiency: a pilot study in multiple sclerosis patients and healthy controls. *Int Angiol* 2010;29:127-139.
 17. Zamboni P, Galeotti R, Menegatti E, Malagoni AM, Giancesini S, Bartolomei I, Mascoli F, Salvi F. A prospective open-label study of endovascular treatment of chronic cerebrospinal venous insufficiency. *J Vasc Surg* 2009;50:1348-1358. e1-e3.
 18. Khan O, Filippi M, Freedman MS, Barkhof F, Dore-Duffy P, Lassmann H, Trapp B, Bar-Or A, Zak I, Siegel MJ, Lisak R. Chronic cerebrospinal venous insufficiency and multiple sclerosis. *Ann Neurol* 2010;67:286-290.
 19. Reekers JA, Lee MJ, Belli AM, Barkhof F. Cardiovascular and Interventional Radiological Society of Europe commentary on the treatment of chronic cerebrospinal venous insufficiency. *Cardiovasc Intervent Radiol* 2011;34:1-2.