# JACO

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# JACO
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June 2012 – Volume 9, Issue 2

Journal of the Academy of Chiropractic Orthopedists
June 2012 – Volume 9, Issue 2

## Image and Art Gallery



## Abstracts and Literature Review - TOS



## Announcements

# Muskoka Sunset - Gravenhurst, ON

*Courtesy of Dr. S. Bacso*

Muskoka Facts:

- Muskoka includes 3,816 square kilometers (1,473 square miles) dotted with more than 400 lakes
- 12% of Muskoka's land base is covered by wetlands, while 18% of the area is water
- The landscape is generally forested and supports diverse ecosystems such as lakes, wetlands, forests, barrens, and open fields
- Muskoka is within a unique region known as "the land between", which is a transitional area between the Canadian Shield and the St. Lawrence Lowlands, stretching across Ontario from Georgian Bay to Kingston
- The area is at the northern or southern range of many rare species and consequently contains diverse habitats of species at risk
- Muskoka is a transition area between the boreal and mixed forests and supports both coniferous and broad-leaved deciduous tree species
- Soils are generally shallow, sandy, and nutrient poor, bedrock is close to the surface
- There are 4 primary and 17 secondary watersheds in Muskoka
- Many lakes in Muskoka act as flood reservoirs
- There are 68 identified heritage areas and sites in Muskoka, which cover 6% of the land base
- There are 4 different types of wetland, all of which can be found in Muskoka
- Wetlands are important for water quality, flood and erosion control, habitat, and recreational opportunities
- Muskoka is home to 250 species of birds, 50 kinds of mammals, and 25 types of reptiles and amphibians
- The watersheds generally support cold or cool water fish species
- Many animals depend on the land-water shoreline interface

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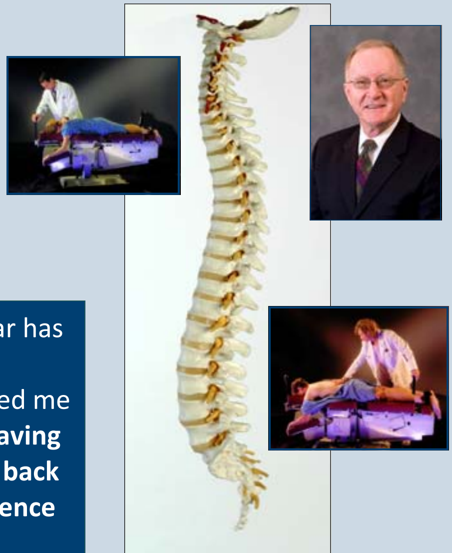

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Abstracts & Literature Review

# Anatomical Connection between the Rectus Capitis Posterior Major and the Dura Mater

Frank Scali, DC, Eric S. Marsili, DC and Matthew E. Pontell , BSc

SPINE - Volume 36, Number 25: E1612-E1614

JACO Editorial Reviewer: Dale G. Huntington, Sr., DC, FACO

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## Authors Abstract:

**Study Design:** Anatomic study performed on 13 cadaveric specimens focused on muscles of the sub-occipital triangle, specifically, the rectus capitis posterior major (RCP ma)

**Objective:** To investigate a connection between the RCP ma and the cervical dura mater.

**Summary of Background Data:** In a study of the posterior intervertebral spaces, a connection between the RCPma and the dura mater was briefly described. To the best of our knowledge, no study has been conducted specifically on this communication.

**Methods:** Anatomic dissections were performed in the sub-occipital regions of 13 embalmed, adult cadaveric specimens. Findings were recorded *via* photographic documentation.

**Results:** In 11 of the 13 specimens, the RCPma attached to the spinous process of the axis and then continued to establish a gross anatomical connection with the dura mater in the atlantoaxial interspace. Manual traction of the RCP ma resulted in gross dural movement from the spinal root level of the axis to the spinal root level of the first thoracic vertebra.

**Conclusion:** A connection was found to exist between the RCPma and the cervical dura mater. Various clinical manifestations may be linked to this anatomical relationship.

**Key words:** cervical spine, posterior atlantoaxial interspace, rectus capitis posterior major, spinal dura.

## Background

The anatomical borders of the sub-occipital triangle are formed by the rectus capitis posterior major (RCPma), obliquus capitis superior and the obliquus capitis inferior. The obliquus capitis inferior attaches the spinous process of the axis to the transverse process of the atlas. The RCPma, obliquus capitis superior and the rectus capitis poster minor (RCPmi) serve to attach the occipital bone to both the atlas and the axis. Previous investigational dissection research has shown anatomical attachment between the RCPmi and cervical dura mater of the posterior atlanto-occipital interspace.

The exact function of the connection is a matter of debate. However it is thought to act to resist dural movement toward the spinal cord during cervical extension and forward translation of the occiput on the atlas. The RCPmi may also monitor stress applied to the dura. Observations during neurosurgical procedures revealed that mechanical stress applied to the dura results in cephalgia. Other studies have shown that chronic headaches in a significant amount of patients are of cervical origin and that specifically the rectus capitis posterior muscles play a role in their development.

To the best of the author's research knowledge, anatomical relationships between the RCPma or the obliquus capitis inferior and cervical dura have neither been documented in other studies nor referenced in conventional anatomical literature. If the RCPma exhibits a connection similar to that of the RCPmi, the RCPma would conceivably exert an even greater mechanical traction on the dura because of its large cross-sectional area.

## Methods and Materials

All thirteen subjects (nine male and four female) of "ages unknown" human cadavers were examined during the study. None of the selected cadavers for the study showed any signs of a history of cervical surgery or trauma. The specimens were fixed with formalin-alcohol-phenol solution. They were obtained from the Department of Anatomical Sciences at St. George's University, and all guidelines were followed for use of cadaveric material in research.

The 13 specimens received an anatomical dissection of the sub-occipital region and posterior cervical spine. Photographic documentation was recorded with a Nikon D-40 camera using two different high resolution lenses. In addition high quality surgical dissection equipment was utilized to remove the obliquus capitis inferior from its origin and insertion points to better visualize the tendinous and fascial components of the RCPma as well as the floor of the atlantoaxial interspace. The RCPma was separated from its attachment sites at the inferior nuchal line and the spinous process of the axis. The deeper fascial connection to the dura mater was preserved and documented in 11 of the 13 specimens.

Mid-sagittal cuts were performed along the bifurcation of the spinous process of the axis and along the right lamina just medial to the zygapophyseal joints bilaterally. This procedure was to completely expose any potential attachment of the RCPma to the dura mater at the atlantoaxial interspace.

In the initial cadaveric specimen, six pins were inserted approximately 4 mm deep into the dorsal aspect of the dura mater. The pins approximated the level of each spinal root from the sixth cervical vertebra to the third thoracic vertebra. The RCPma was tractioned posteriorly with forceps and movement of the pins was observed. The attachment was tested in the initial specimen via posterior, inferior and superior traction of the RCPma.

## Results

In all the 13 specimens the RCPma was firmly attached to the spinous process of the axis. In 11 of the 13 cadaveric specimens the RCPma attached to the laminae of the axis but mainly sent dense conjunctive tracts through the atlantoaxial interspace, into the vertebral canal, to the posterior surface of the dura mater. These fibers provided a firm attachment between the RCPma and the cervical dura. The obliquus capitis inferior seemed to send similar conjunctive fibers toward the dura mater as well. However the obliquus capitis superior did not.

Applied traction of the RCPma resulted in movement from the spinal root level of the axis to the spinal root level of the first thoracic vertebra. In the two specimens that did not posses this anatomical connection, manual traction of the RCPma did not result in any dural movement.

## Conclusions

It seems clear the investigative research of these clinicians has produced solid evidence of the connection between the RCPma and the dura mater adding increased strength to the attachment.

## Clinical Relevance

The clinical implications for the doctor of chiropractic or orthopedic specialist is the affirmation of the RCPma helping to provide credence to the influence of the chiropractic manipulative techniques with conditions such as cephalgia.

## JACO Editorial Summary

- The article was written from the School of Medicine, St. George's University , Granada , West Indies: and North Beechmont Chiropractic Center, Cincinnati, OH.
- The article was well done and a credit to our profession to be an original research article to be published in an internationally recognized indexed medical journal such as Spine.
- The sole purpose of this investigational research confirmed what many chiropractic educators and clinicians suspected clinically but lacked the dissection techniques and technology to prove the connection of the RCPma connection to the dura mater.
- The protocols appear to have been strictly followed allowing for the credibility it deserves utilizing the best imaging technology and precise dissection techniques.
- This important research will lead others along the path of further discovery. In this case we should be proud of these ambitious inquisitive clinicians within our profession to have taken on the task.

## References

1. Standring S. *Gray's Anatomy: The Anatomical Basis of Clinical Practice* . 40th ed . Philadelphia, PA : Elsevier Saunders; 2008.
2. Hack GD, Kortizer RT, Robinson WL, et al. Anatomic relation between the rectus capitis posterior minor muscle and the dura mater . *Spine* 1995; 20 : 2484-6.
3. Nash L, Nicholson H, Lee AS, et al. Configuration of the connective tissue in the posterior atlanto-occipital interspace: a sheet plastination and confocal microscopy study. *Spine* 2005; 30: 1359-66.
4. Alix ME, Bates DK. A proposed etiology of cervicogenic headahce: the neurophysiologic basis and anatomic relationship between the dura mater and the rectus capitis posterior minor muscle. *J Manipulative Physiol Ther* 1999 ; 22: 534-9.
5. McPartland JM, Brodeur RR. Rectus capitis posterior minor: a small but important suboccipital muscle . *J Bodywork Movement Ther* 1999; 1: 30-5.
6. Rutten HP, Szpak K, van Mameren H, et al. Letter to the editor. *Spine* 1997; 22: 924-6.
7. Hack GD , Hallgren RC . Chronic headache relief after section of suboccipital muscle dural connections: a case report . *Headache* 2004; 44: 84-9.
8. Grgic V. Cericogenic headache: etiopathogenesis, characteristics, diagnosis, differential diagnosis, and therapy [in Croatian] . *Lijec Vjesn* 2007; 129: 230-6.
9. Tagil SM, Ozçakar L, Bozkurt MC. Insight into understanding the anatomical and clinical aspects of supernumerary rectus capitis posterior muscles. *Clin Anat* 2005; 15: 373-5.
10. Fernández-de-Las-Peñas C, et al. Magnetic resonance imaging study of the morphometry of cervical extensor muscles in chronic tension-type headache . *Cephalgia* 2007; 27: 355-62.
11. Fleckenstein P, Tranum-Jensen J. *Anatomy in Diagnostic Imaging* - 2nd ed. Philadelphia, PA : Elsevier Saunders; 2001
12. Rohen JW, Chihiro Y. in *Color Atlas of Anatomy* . 2nd ed. New York, NY: Igaku-Shoin; 1988: 87.
13. Abrahams PH, Boon JM, Spratt JD. Head, Neck, and Brain in: *McMinn's Clinical Atlas of Human Anatomy* . 6th ed. Philadelphia, PA : Elsevier Saunders; 2008: 62-3.
14. Guyton AC. Contraction of skeletal muscle in *Textbook of Medical Physiology* . 11th ed. Philadelphia, PA : Elsevier Saunders; 2006.
15. Yousry I, Förderreuther S, Moriggl B, et al. Cervical MR imaging in postural headache: MR signs and pathophysiological implications. *Am J Neuroradiol* 2001; 22: 1239-50.
16. Bates B. *A Guide to Physical Examination and History Taking* . 5th ed. Philadelphia, PA: J.B. Lippincott; 1991: 471 .

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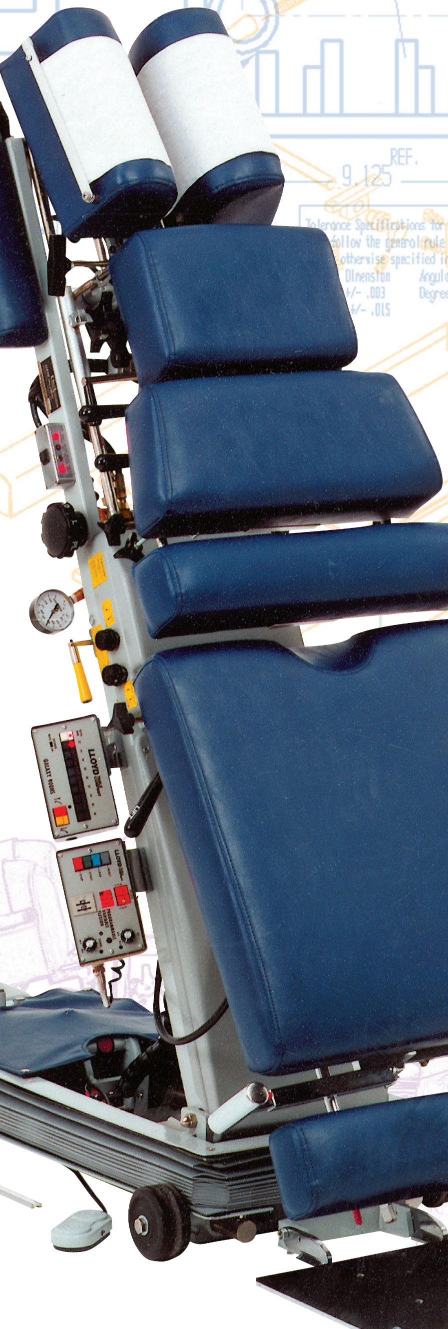

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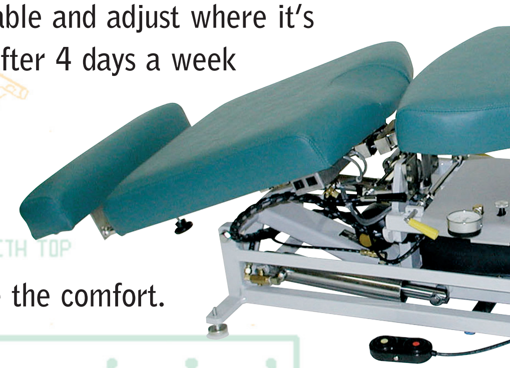

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Abstracts & Literature Review

# The Possible Role of Cranio-Cervical Trauma and Abnormal CSF Hydrodynamics in the Genesis of Multiple Sclerosis

Raymond V. Damadian and David Chu

Physiol. Chem. Phys. & Med. NMR (2011) 41: 1–17

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## Authors' Abstract:

UPRIGHT® Multi-Position™ MR scanning has uncovered a key set of new observations regarding Multiple Sclerosis (MS), which observations are likely to provide a new understanding of the origin of MS. The new findings may also lead to new forms of treatment for MS.

The UPRIGHT® MRI has demonstrated pronounced anatomic pathology of the cervical spine in five of the MS patients studied and definitive cervical pathology in the other three. The pathology was the result of prior head and neck trauma. All eight MS patients entered the study on a first come first serve basis without priority, and all but one were found to have a history of serious prior cervical trauma which resulted in significant cervical pathology.

The cervical pathology was visualized by UPRIGHT® MRI. Upright cerebrospinal fluid (CSF) cinematography and quantitative measurements of CSF velocity, CSF flow and CSF pressure gradients in the upright patient revealed that significant obstructions to CSF flow were present in all MS patients. The obstructions are believed to be responsible for CSF "leakages" of CSF from the ventricles into the surrounding brain parenchyma which "leakages" can be the source of the MS lesions in the brain that give rise to MS symptomatology.

The CSF flow obstructions are believed to result in increases in intracranial pressure (ICP) that generate "leakages" of the CSF into the surrounding brain parenchyma. In all but one MS patient, anatomic pathologies were found to be more severe in the upright position than in the recumbent position. Similarly, CSF flow abnormalities were found to be more severe in the upright position than in the recumbent position in all but one MS patient. Images of the MS patient anatomic pathologies and CSF flow abnormalities are provided with comparison images from normal examinees in Figures 1–15 of this paper.

## Background

As is the case with much of science, in this study by Damadian and Chu, basic observation prompted the asking of certain questions and devising the subsequent research that attempts to answer the question posed. The question centered on asking whether abnormal fluid dynamics of cerebrospinal fluid (CSF) was playing a role in the generation of multiple sclerosis (MS) lesions. The observations which prompted this question were the presence of an MS lesion directly within a brain ventricle and the tendency for MS lesions to be periventricular.

## Methods

Eight subjects with MS and seven normal subjects were imaged using in the upright and recumbent positions utilizing Fonar Upright Multiposition MRI. Quantitative measurements of CSF flow were calculated for all subjects. Two of the MS subjects could not be tested in recumbent position, one due to vertigo and the other due to lower limb paralysis.

## Results

Results included the following 3 findings:

1. Abnormal CSF flow was noted in all eight MS patients, but in none of the normal subjects.
2. A history of significant cervical spine trauma was noted in 6 of the 8 MS subjects and of the remaining 2, one of them had significant possibility of prior cervical trauma.
3. CSF inflow and inflow velocity was half of the recumbent measurements in the upright position for all subjects, those with and without MS.

In addition, interstitial periventricular edema was noted in all eight of the MS patients. There appeared to be direct leakage of CSF from the ventricles into the parenchymal tissue of the brain, with MS plaque formation noted at the site of these leaks in the MS patients.

The increased CSF flow and velocity has been shown in previous studies to correlate with increased intracranial pressure (ICP).

## Conclusions

The authors suggest that the altered CSF flow and velocity, as well as the presence of prior cervical spine trauma with resulting anatomical pathology in the cervical spine might all play a part in the genesis of multiple sclerosis (MS). The possible mechanism of action sequentially would be cervical spine trauma leads to both cervical spine pathology and leaking of CSF into periventricular tissues.

The cervical spine pathology may lead to altered CSF flow and velocity which has been shown to lead to increased intracranial pressure (ICP) which may lead to the genesis of MS plaques within brain tissue. In addition, the CSF leaks into periventricular brain tissue brings with it polypeptides and antigens not found in blood, which may also precipitate MS plaques.

## Clinical Relevance

New imaging techniques utilizing MRI allow for quantitative mensuration of CSF hydrodynamics and have demonstrated some previously unknown findings in both normal and MS subjects: an increase in CSF flow and velocity when changing from the upright to the recumbent position for both normal and MS subjects; in addition, MS subjects have demonstrated abnormal CSF flow and velocity.

While some preliminary evidence suggests a possible role of trauma in the genesis of MS, as chiropractors we know all too well the erroneous conclusions that may come from a retrospective cohort study such as this. Two large cohort studies suggested a causal relationship between cervical spine manipulation and vertebrobasilar stroke. Only a much larger study by Cassidy provided evidence that the relationship is probably not causal, even though CMT has the potential to advance a stroke in progress. Again, the suggested correlation between MR imaged anatomical pathology in the cervical spine and the onset of MS may be true or it may be erroneous. The paper did not discuss the history of cervical trauma for the normal subjects.

The authors did attempt to correlate the increase in CSF flow from upright to recumbent position based upon some anatomical pathology which caused stenosis (in-folding of ligamentum flavum) in the upright but not recumbent positions. However, this CSF flow change was noted in all test subjects, those with and those without MS.

The authors also pose an interesting question regarding the suggested autoimmune nature of MS. Given that CSF is composed of over 300 polypeptides, with 9 antigenic species that are absent from blood serum, perhaps the leaking of CSF, with its polypeptides and antigens, into brain parenchymal tissue could trigger an autoimmune response and therefore MS plaques?

Of course, this does not explain the presence of MS plaques that are far removed from proximity to CSF. Interestingly, these same CSF antigens have been found outside of the CSF and within brain tissue in those with repeated head trauma, such as professional soccer players or football players, suggesting that trauma to the head may precipitate this leaking of CSF.

The ultimate role that altered CSF hydrodynamics plays in MS, and has also been suggested Alzheimer's disease, remains to be seen. However, the advent of new MR imaging techniques which allow the quantitative determination of CSF flow and velocity may open many avenues for research.

## Summary

This observational study may pose more questions than it answers, such as:

1. Why does CSF flow increase dramatically in the recumbent versus upright position for all subjects when cerebral blood flow is not at all affected by position?
2. What really constitutes 'normal' cervical spine anatomy when most of the normal subjects in this study, while asymptomatic, had abnormalities found on the cervical MRI, ranging from disc bulges to localized interruptions of CSF flow?
3. Does trauma truly have a causal effect upon MS?
4. What role does increased CSF flow, and therefore increased CSF pressure, play in the genesis of MS?

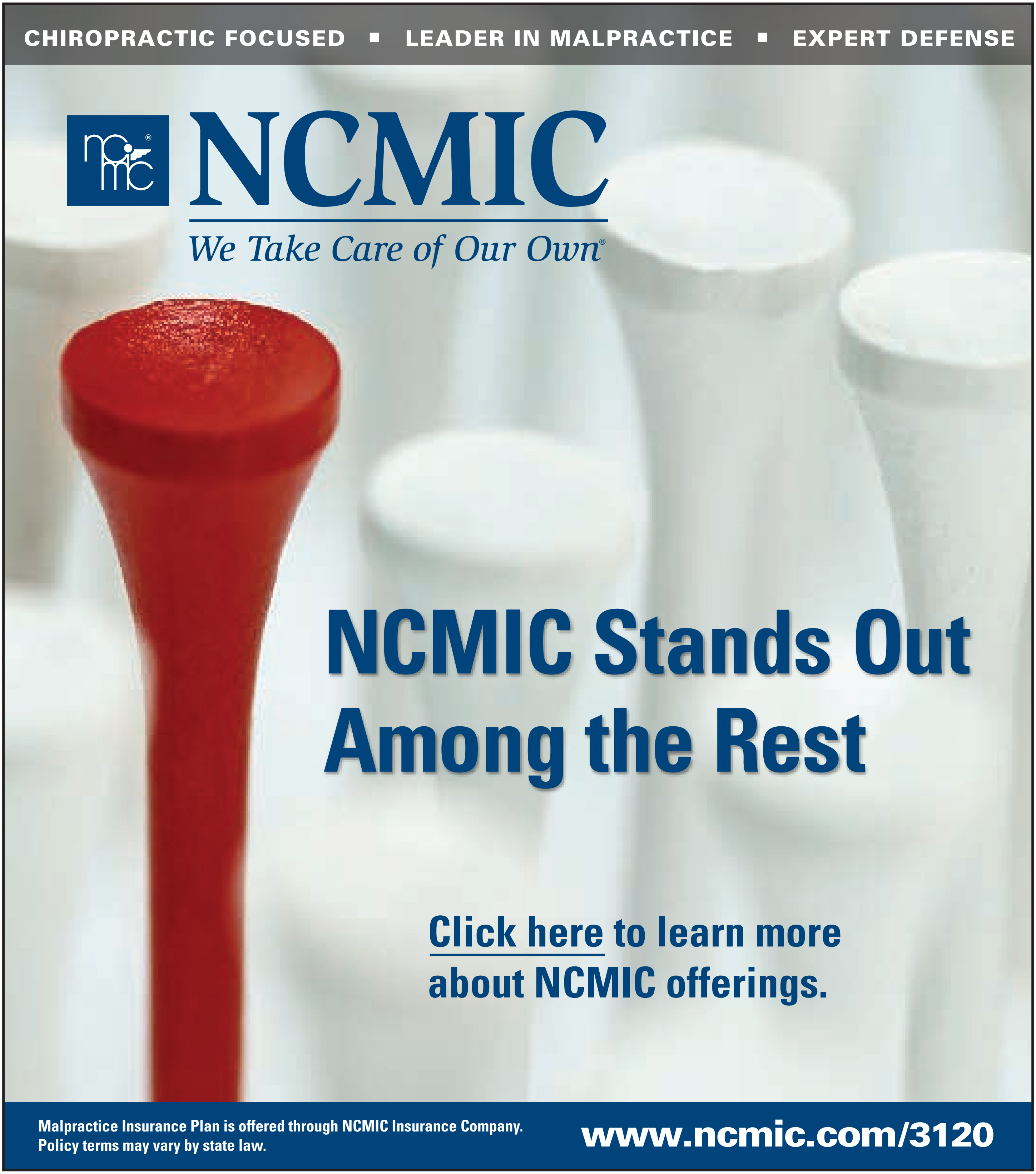
## JACO Editorial Summary

- The authors began their study by the simple observation that when imaged in the upright position, MS plaque lesions were observed to be arising either directly in the ventricle or have a tendency to be periventricular
- New imaging techniques with FONAR MRI now allow the measurement of CSF flow hydrodynamics, allowing for the calculation of flow and flow velocity
- The authors compared MRI findings (both anatomical and hydrodynamic) between eight MS subjects and seven normal subjects
- Significant findings included: abnormal CSF flow and velocity in all eight MS subjects and in none of the normal subjects; significant prior cervical spine trauma was noted in 6 and possibly 7 of the MS subjects; CSF flow and velocity dropped in half from the recumbent to upright posture in both normal and MS subjects
- The authors posed several hypotheses regarding the etiology of MS based upon these findings, suggesting that prior trauma may play a role in the genesis of MS. The prior trauma may cause CSF leakage into surrounding brain tissue with subsequent autoimmune response from 'tau' antigens from CSF not found in blood serum. They also suggest that prior cervical spine trauma results in cervical anatomical pathology which may result in altered CSF hydrodynamics which then results in increased intracranial pressure (ICP) which results in MS plaques.

## References

1. Young, I.R., Hall, A.S., Pallis, C.A., et al. (1981) *Lancet*, 318: 1063.

2. Lakhanpal, S.K. and Maravilla, K.B. (1999) in *Magnetic Resonance Imaging*, Eds. Stark, David D., Bradley, Jr., William G., Edition III, p. 1381, Figure 61-2, 61-3, Mosby, Inc.
3. Alperin, N., et al (2005) *Journal of Magnetic Resonance Imaging*, 22: 591–596.
4. Haughton, V.M., Korosec, F.R., Medow, J.E., Dolar, M.T., and Iskandar, B.J. (2004) *AJNR, Am. J. Neuroradiol.*, 24:169.
5. Ouchi,Y., Nobezawa, S.,Yoshikawa, E., Futatsubashi, M., Kanno, T., Okada, H., Torizuka, T., Nakayama, T. and Tanaka, K. (2001) *J. Cerebral Blood Flow and Metabolism*, 21: 1058–1066.
6. Brain, W., Wilkinson, M. (1957) *Brain* 80: 456-478.
7. Poser, C.M. (2000) *Arch. Neurol.* 57: 1074-1077.
8. Martinelli, V. (2000) *Neurol. Sci*., 21: 5849-5852.
9. Bunketorp, L., Nordholm, L., Carlsson, J. (2002) *Eur. Spine J.* 11: 227 (227-234).
10. Struck, A.F and Haughton, V.M. (2009) *Radiology* 253, No. 1: 185.
11. Alperin, N., Lee, S., Loth, F., Raskin, P., Lichtor, T. (2000) *Radiology* 217: 877-885 (Fig. 8).
12. Felgenhauer, K. (1974) *Klin. Wochenschr*. 52 24): 1158-1164.
13. Merril, C.R., Goldman, D., Sedman, S.A., Ebert, M.H. (1981) *Science* 211: 1437-1438.
14. Laterre, C., Heremans, J., Carbonara, A. (1964) *Clin. Chim. Acta.* 10: 197.
15. Bock E. *A Manual of Quantitative Immunoelectrophoresis*, Axelen, N.H., Kroll, J., Weeke, B., Eds., *Universitetsforlaget*, Oslo, 1973: 119-124.
16. Sjögren, M., Vanderstichele, H., Ågren, H., Zachrisson, O., Edsbagge, M., Wikkelsø, C., Skoog, I., Wallin, A., Wahlund, L., Marcusson, J., Nägga, K., Andreasen, N., Davidsson, P., Vanmechelen, E., Blennow, K. (2001) *Clinical Chemistry* 47: 1776-1781.
17. Zamboni, P., Galeotti, R., Menegatti, E., Malagoni, A., Gianesini, S., Bartolomei, I., Mascoli, F., Salvi, F. (2009) *J. Vascular Surgery* 50(6): 1348-1358.
18. Schoser, B., Reimenschneider, N., Hansen C. (1999) *J. Neurosurg*. 91: 744–749.
19. McKee, A., Gavett, B., Stern, R., Nowinski, C., Cantu, R., Kowall, N., Perl, D., Hedley-Whyte, E., Price, B., Sullivan, C., Morin, P., Lee, H., Kubilus, C., Daneshvar, D., Wulff, M., Budson, A. (2010) *J. Neuropathol. Exp. Neurol*. 69(9): 918-929.
20. Xin, M., Yue, T., Ma, Z., Wu, F., Gow, A. and Lu, Q. (2005) *J. Neurosci*. 25(6): 1354-1365.
21. Department of Neurological Surgery, Columbia University Medical Center (http://www.columbianeurosurgery.org/conditions/adult-hydrocephalus).
22. Freeman, M., Rosa, S., Harshfield, D., Smith, F., Bennett, R., Centeno, C., Kornel, E., Nystrom, A., Heffez, D., Kohles, S. (2010) *Brain Injury*, 24(7–8):988–994.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Abstracts & Literature Review

# Sonographic Evaluation of the Greater Occipital Nerve In Unilateral Occipital Neuralgia

John Chin-Suk Cho, DC, Daniel W. Haun, DC, Norman W. Kettner, DC

J Ultrasound Med 2012; 31: 37-42

JACO Editorial Reviewer: Gregory C. Priest, DC, FACO

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## Authors' Abstract:

**Objectives:** Occipital neuralgia is a headache that may result from greater occipital nerve entrapment. Entrapped peripheral nerves typically have an increase in cross-sectional area. The purpose of this study was to measure the cross-sectional area and circumference of symptomatic and asymptomatic greater occipital nerves in patients with unilateral occipital neuralgia and to correlate the greater occipital nerve cross-sectional area with headache severity, sex and body mass index.

**Methods:** Both symptomatic and contralateral asymptomatic greater occipital nerve cross-sectional areas and circumferences were measured by a single examiner using sonography in 17 patients. The Wilcoxon signed rank test and Spearman rank order correlation coefficient were used to analyze the data.

**Results:** Significant differences between the cross-sectional areas and circumferences of the symptomatic and asymptomatic greater occipital nerves were noted ($P < .001$). No difference existed in cross-sectional area ($P = .40$) or circumference ($P = .10$) measurements of the nerves between male and female patients. A significant correlation existed between the body mass index and symptomatic ($r = 0.424$; $P = .045$) and asymptomatic ($r = 0.443$; $P = .037$) cross-sectional areas. There was no correlation shown between the cross-sectional area of the symptomatic nerve and the severity of Headache Impact Test 6 scores ($r = –0.342$; $P = .179$).

**Conclusions:** We report sonographic evidence showing an increased cross-sectional area and circumference of the symptomatic greater occipital nerve in patients with unilateral occipital neuralgia.

**Key Words:** greater occipital nerve; headache; occipital neuralgia; sonography.

## Background

The authors note that occipital neuralgia is a condition defined as paroxysmal stabbing pain, with or without persistent aching between episodes, in the distributions of the greater, lesser and third occipital nerves. The diagnosis of occipital neuralgia is achieved primarily through history and physical examination, as no imaging studies to date have been shown to be of significant value in the diagnosis of this condition. The authors evaluated a cohort of patients suffering from symptoms consistent with unilateral occipital neuralgia for various data points, including cross-sectional area and circumference of the greater occipital nerve, as well as possible correlation with headache severity, sex and body mass index (BMI). They acknowledge that one of the proposed etiologies of occipital neuralgia is entrapment with subsequent irritation of the greater occipital nerve, and delineate possible anatomical zones where such entrapment may be more likely to occur.

## Methods

The study includes a cohort of 53 patients between the ages of 21-44 years old with unilateral suboccipital headache of at least 12 months duration, frequency of at least once per week for the previous four weeks before enrollment, no head/neck surgery or trauma during the previous six months, no history of collagen vascular disease, and actively seeking treatment for suboccipital headache. Further, patients must have met two of the three criteria delineated by the International Headache Society of the diagnosis of occipital neuralgia. Patients were examined utilizing a published sonography protocol and bilateral measurements were made.

## Results

Significant differences were noted between the symptomatic and asymptomatic cross-sectional areas and circumferences of the greater occipital nerve. No difference was noted between male and female patients for cross-sectional area or circumference. Spearman rank order correlation showed significant correlations of the symptomatic and asymptomatic greater occipital nerve cross-sectional areas with the BMI.

No correlation was shown between the cross-sectional area of the symptomatic nerve and the severity of the Headache Impact Test 6 scores. One statistical outlier was identified and omitted from the analysis and the values recalculated. This resulted in Spearman rank order correlation which showed a small but significant correlation of the symptomatic and asymptomatic greater occipital nerve cross-sectional areas with the BMI. No correlation was shown between the cross-sectional area of the symptomatic nerve and the severity of the of the Headache Impact Test 6 scores.

## Conclusions

Occipital neuralgia is a condition that can lead to intractable headaches occurring in the distribution of the greater occipital nerve, usually unilateral in location and more frequently noted in women than men. There are areas proposed where entrapment of the greater occipital nerve may occur. The authors chose to evaluate the specific zone in the fascial plane between the obliquus capitis inferior and semispinalis capitis muscles due to the ability to assess the greater occipital nerve sonographically at that site. Significant differences were noted between the cross-sectional areas and circumferences of the greater occipital nerves between symptomatic and asymptomatic sides.

Significant correlations between the BMI and the cross-sectional area as well as the circumference of the greater occipital nerve were found. The authors acknowledge that the small sample size presents a limitation of this study, as well as the mean age of the cohort which was not felt to be representative of the typical age of the population in which occipital neuralgia occurs. Further, the diagnosis of occipital neuralgia was not confirmed by diagnostic blockade in most cases, which may have led to inclusion of some patients with false-positive findings. Further studies were recommended to help clarify the role of sonography in the diagnosis of occipital neuralgia.

## Clinical Relevance

This study may serve as a valuable resource for those with clinical interest in sonographic evaluations as part of the diagnostic evaluation of patients with occipital neuralgia, in that it provides a data set for future comparison of greater occipital nerve measurements in this subset of affected patients.

## JACO Editorial Summary:

- Patients with unilateral occipital neuralgia that met study selection criteria were evaluated sonographically for cross-sectional area and circumference of the greater occipital nerve bilaterally, and the resulting data were analyzed.

- Significant differences were noted between the symptomatic and asymptomatic cross-sectional areas and circumferences of the greater occipital nerve.
- No significant difference was noted between males and females for cross-sectional area or circumference.
- Significant correlation was noted between BMI and greater occipital nerve cross-sectional area and circumference.
- Future studies with a larger patient cohort may allow for an expanded data set which will no doubt be a valuable resource for those investigators seeking to develop normative values for sonographic evaluation of the greater occipital nerve.

## Summary

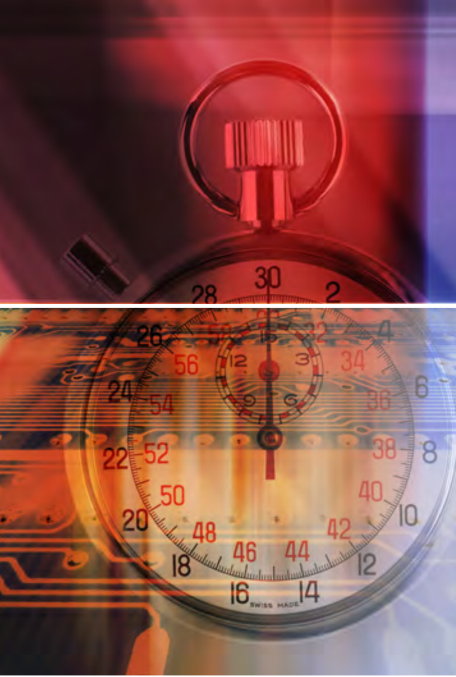
The results of this study suggest that sonographic evaluation of selected patients with unilateral occipital headaches may be beneficial in confirming the clinical diagnosis of occipital neuralgia.

## References

1. Headache Classification Subcommittee of the International Headache Society. The International Classification of Headache Disorders: 2nd edition. *Cephalalgia* 2004; 24(suppl 1): 9–160.
2. Loukas M, El-Sedfy A, Tubbs RS, et al. Identification of greater occipital nerve landmarks for the treatment of occipital neuralgia. *Folia Morphol* (*Warsz*) 2006; 65: 337–342.
3. Cho JC, Haun DW, Kettner NW, Scali F, Clark TB. Sonography of the normal greater occipital nerve and obliquus capitis inferior muscle. *J Clin Ultrasound* 2010; 38: 299–304.
4. Greher M, Moriggl B, Curatolo M, Kirchmair L, Eichenberger U. Sonographic visualization and ultrasound-guided blockade of the greater occipital nerve: a comparison of two selective techniques confirmed by anatomical dissection. *Br J Anaesth* 2010; 104:637–642. J Ultrasound Med 2012; 31: 37.
5. Gelberman RH, Eaton RG, Urbaniak JR. Peripheral nerve compression. *Instr Course Lect* 1994; 43: 31–53.
6. Klauser AS, Halpern EJ, De Zordo T, et al. Carpal tunnel syndrome assessment with US: value of additional cross-sectional area measurements of the median nerve in patients versus healthy volunteers. *Radiology* 2009; 250: 171–177.
7. Yoon JS, Walker FO, Cartwright MS. Ultrasonographic swelling ratio in the diagnosis of ulnar neuropathy at the elbow. *Muscle Nerve* 2008; 38: 1231–1235.
8. KimOS, Jeong SM, Ro JY, et al. Fluoroscopy and sonographic guided injection of obliquus capitis inferior muscle in an intractable occipital neuralgia. *Korean J Pain* 2010; 23: 82–87.
9. Kuhn WF, Kuhn SC, Gilberstadt H. Occipital neuralgias: clinical recognition of a complicated headache—a case series and literature review. *J Orofac Pain* 1997; 11: 158–165.
10. Kapoor V, Rothfus WE, Grahovac SZ, Amin Kassam SZ, Horowitz MB. Refractory occipital neuralgia: preoperative assessment with CT-guided nerve block prior to dorsal cervical rhizotomy. *AJNR Am J Neuroradiol* 2003; 24: 2105–2110.
11. Dash KS, Janis JE, Guyuron B. The lesser and third occipital nerves and migraine headaches. *Plast Reconstr Surg* 2005; 115: 1752–1758.
12. Mosser SW, Guyuron B, Janis JE, Rohrich RJ. The anatomy of the greater occipital nerve: implications for the etiology of migraine headaches. *Plast Reconstr Surg* 2004; 113: 693–697.
13. Janis JE, Hatef DA, Ducic I, et al. The anatomy of the greater occipital nerve, part II: compression point topography. *Plast Reconstr Surg* 2010; 126: 1563–1572.
14. Gille O, Lavignolle B, Vital JM. Surgical treatment of greater occipital neuralgia by neurolysis of the greater occipital nerve and sectioning of the inferior oblique muscle. *Spine* (*Phila Pa 1976*) 2004; 29: 828–832.
15. Ducic I, Moriarty M, Al-Attar A. Anatomical variations of the occipital nerves: implications for the treatment of

chronic headaches. *Plast Reconstr Surg* 2009; 123: 859–863.

16. Becser N, Bovim G, Sjaastad O. Extracranial nerves in the posterior part of the head: anatomic variations and their possible clinical significance. *Spine* 1998; 23: 1435–1441.
17. Kosinski M, Bayliss MS, Bjorner JB, et al. A six-item short-form survey for measuring headache impact: theHIT-6. *QualLifeRes*2003; 12: 963–974.
18. Nachit-Ouinekh F, Dartigues JF, Henry P, et al. Use of the Headache Impact Test (HIT-6) in general practice: relationship with quality of life and severity. *Eur J Neurol* 2005; 12: 189–193.
19. Ashkenazi A, Levin M. Greater occipital nerve block for migraine and other headaches: is it useful? *Curr Pain Headache Rep* 2007; 11: 231–235.
20. Afridi SK, Shields KG, Bhola R, Goadsby PJ. Greater occipital nerve injection in primary headache syndromes: prolonged effects from a single injection. *Pain* 2006; 122: 126–129.
21. Young WB, Marmura M, Ashkenazi A, Evans RW. Expert opinion: greater occipital nerve and other anesthetic injections for primary headache disorders. *Headache* 2008; 48: 1122–1125.



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