

The Etiology of Vertebrobasilar Stroke Temporally Related to Cervical Manipulation: Part II

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Does the information brought out in the recent literature relieve the manipulative process of any implication of causality? It clearly does not. Though there are many instances, in which a patient has been adjusted a number of times without an acute ischemic event, there are also those reports that describe immediate symptoms of stroke, some in which mortality has resulted.^{6,7,8,17}

The mechanism of the immediate ischemic symptoms is not definite. It seems unlikely that any form of dissection could occur with enough rapidity to result in immediate stroke or ischemic symptoms. A much more plausible mechanism would be of a pre-existing dissection and clot that following manipulation, embolizes to a distal artery to a point too small to pass through and produces ischemia. It may also be possible, especially in those individuals with transient symptoms, that there is a hypoplastic vertebral artery; the larger artery is occluded as the procedure of rotation and extension is performed (this has been shown to occur both in vivo and in vitro),⁶ and blood flow to neural structures is rapidly decreased for a short time.

If dissection is pre-existing at the time a patient presents to a chiropractor's office, is there a way to determine its existence before initiating adjustive therapy? Though the signs and symptoms of vertebral artery dissection are variable, dependent primarily on whether ischemia is also taking place, a careful history and examination, along with a degree of suspicion that dissection is a possible diagnosis in patients with neck and headache pain, should help to identify those patients undergoing this process.

Further, a review of the literature would suggest that, however small the number of vertebrobasilar strokes occurring in some sort of relationship to chiropractic manipulation may be, that this number should be reducible. Primary in this effort are two factors. One, as mentioned earlier, is to be very suspicious of the possibility of this pathology in light of certain findings to be described shortly. The second, is to terminate care if it is found that symptoms suggesting ischemia arise after adjusting, and to initiate a workup to assess the possibility of this pathology.

Tragically in the past there have been occasions when a chiropractor has continued adjustive therapy following the manifestation of symptoms of vertebrobasilar stroke or ischemia by a patient.^{7,8,15,17} Frequently these patients have suffered the effects of a progressive dissection. If the doctor had been astute to the signs of this condition, and made a prompt referral for an assessment of cervicocephalic artery dissection, any great degree of morbidity could have probably been altogether avoided.

Important to chiropractors is that the primary symptom of dissection of the extracranial, and/or intracranial vertebral arteries, is pain of the neck and/or occiput.^{1,2,5,18,27,32,34,35} This pain can precede other signs and symptoms by at times several weeks,^{5,18,32} and on occasion, will not occur at all.²³ Pain is without a doubt one of the most frequent reasons patients present to a chiropractor's office for treatment that is directed to the neck.

The fact that large hospitals see between one to three cases of ischemia due to vertebral artery dissection per year,^{22,32} reflects the fact that these patients are only to be infrequently encountered. This may predispose doctors to be less diligent in actively assessing for the possibility of this pathology in those patients with neck and/or headache pain than would otherwise be seen. To miss this diagnosis however, and as has been illustrated earlier, can result in serious consequences.

As mentioned earlier, the most common symptom of vertebral artery dissection is pain, either of the neck, or the occipital area of the head. This is reported as the presenting symptom in 80% of the cases of one study with literature review,³² and 73% in another.⁵ Symptoms also associated are: retro-orbital pain; generalized headache, nausea, dizziness, vertigo; difficulty talking and/or swallowing; vomiting; loss of sensation of half of the tongue or half of the face; blurred vision; loss of sensation of one half of the trunk and/or the ipsilateral extremities, and difficulty walking.

An examination might reveal one or many of the following findings: ataxia; paresis of cranial nerves,^{3,6,7,9,12} limb dysmetria; dysarthria; dysphagia; an extensor toe sign; nystagmus; loss of pain and temperature sensation of one side of the face; hemianesthesia of the extremities and/or trunk. The loss to the extremities and trunk are contralateral to the side of the face affected. The cranial nerve losses would manifest in a loss of the gag reflex, the inability of one side of the soft palate to raise, weakness of the tongue to abduction, and heterotropia. There may also be miosis, ptosis, and anhidrosis. Also noticed may be a change in facial symmetry, due to paresis of the seventh cranial nerve.

In light of the fact that a fair number of patients with dissection present with multiple cervicocephalic artery dissection, signs and symptoms of carotid artery dissection should also be ruled out, as a patient with a carotid artery dissection may have a silent vertebral artery dissection, and of course is not a candidate at that time for cervical manipulation.

Presenting features of carotid artery dissection include: TIA and stroke; pain in the ipsilateral face; retro-orbital pain; neck pain (this is frequently felt in the anterior neck as opposed to VA dissection); and unilateral headache. The patient may present monocular blindness, or Horner's syndrome. About one third of patients describe pulsatile tinnitus of the ipsilateral ear. Involvement of the lingual artery would cause paralysis of the tongue, while involvement of the facial artery causes claudication of the jaw. Migraine or cluster type headache symptoms have also been described.

Differential diagnosis include: cardiac embolism, radiation arteriopathy, migrainous ischemia, hypercoagulable states in lupus erythematosus, malignancy, mass effect of tumor or aneurysm, or mechanical occlusion of the vertebral artery.²⁶ This last condition is caused by the tendons of the longus coli and scalenus anticus muscles at their attachment to the transverse process of the sixth cervical vertebrae.

Also to be considered is the possibility that an alteration in sensory afferent input can cause many of

the symptoms associated with dissection. This is in light of a study done in which the anesthetization of the dorsal root produced: disorientation; imbalance; incoordination; light-headedness; an empty feeling in the pit of the stomach; ataxic gait; hypotonia of the ipsilateral arm and leg; past pointing, and a positive Romberg's sign. This did not however produce dysarthria or dysmetria.³⁹ The literature supports the fact that most vertebral artery dissections do not result in mortality,^{5,18,21,32,35} that a large portion of these heal in a relatively short time,^{18,32} and that although reoccurrence of dissection in the remaining cervicocephalic arteries may occur, this does not appear to occur in the originally dissected vessel.³¹

Treatment of patients presenting with symptoms of vertebrobasilar or posterior circulation stroke or ischemia is dependent on the location of the dissection, the extent of the pathology occurring, and the prior experience of the physician or surgeon. Almost all extracranial vertebral artery dissections have been treated nonsurgically.^{5,18,32} Most extracranial vertebral artery dissections will heal spontaneously, or with medical treatment, in a relatively short time.^{5,18,31,32} One study, of 20 cases with repeat angiography performed within three months of the first, showed 60% of their arteries were already normal, and 40% were improved.³²

The treatment of intracranial vertebral artery dissections is dependent on whether subarachnoid hemorrhage is present or not. Most, though not all intracranial vertebral artery dissections presenting with subarachnoid hemorrhage, have been treated surgically,^{3,21,33,34,37} a few have been treated with observation, and some with anticoagulant or antiplatelet therapy.³ Intracranial vertebral artery dissection not presenting with subarachnoid hemorrhage has been treated successfully by both surgical means, and with observation.³

The fact that dissecting intracranial vertebral arteries, presenting with subarachnoid hemorrhage and without, have been treated successfully in a conservative fashion, reveals that definitive treatment of this pathology has not as yet been established.

Dissection of cervicocephalic arteries is found to occur most frequently in patients in their 30s and 40s, and is not associated with atherosclerotic changes. There appears to be no gender preference in extracranial vertebral artery dissection, though intracranial vertebral artery dissection appears to occur more often in males.^{1,2,33,34}

The gold standard in the diagnosis of vertebral and carotid artery dissection is arteriography, which in light of the fact that many times more than one vessel is involved, should be done to image all four cervicocephalic arteries.

Arteriography, however, is an invasive procedure. Due to this, attempts have been made to utilize ultrasonography and MRI in the detection of this pathology.

Though as yet, little is known of the specificity and sensitivity of these two methods when compared to angiography, there is some evidence that use of these diagnostic procedures in the assessment of vertebral or carotid artery dissection can be an accurate method of diagnosis in some cases.²¹

Ultrasound appears to be much more reliable when utilized to image the carotid arteries than the

vertebral arteries.²¹ At this time, it appears to be accurate in the diagnosis of dissection in vertebral or carotid arteries in a little more than 50% of the cases studied.²¹

Recent studies of the efficacy of MRI in diagnosing this pathology shows it to be a much more accurate tool, though again, better in determining carotid artery pathology than vertebral artery pathology.^{19,20,21}

Further use of MRI in the diagnosis of this pathology, should enhance the ability of radiologists to detect dissection of the cervicocephalic arteries, thereby reducing the roll of angiography in the initial diagnosis of this pathology, as well as in subsequent assessment of the patient.

In summary, it has been put forth in a number of reports, that vertebrobasilar ischemia and stroke can be caused by chiropractic manipulation. The reasons this appears to be held as accurate, is that there is a relationship in time between the manipulative procedure and the ischemic event, and that until recently, the actual pathology itself, as well as the pattern in which it occurs, had yet to be accurately described.

The fact that many of these dissections occur spontaneously; that often more than one of the cervicocephalic arteries are affected; that injury to the osseous and neural structures of the neck, severe enough to cause death infrequently causes injury to the vertebral arteries; that there appears to be a statistically significant correlation between cervicocephalic artery dissection and migraine, hypertension, oral contraceptive use, and fibromuscular dysplasia; that there appears to be a genetic relationship in a number of individuals afflicted; and that recent research suggests increased levels of plasma homocysteine can cause arteriopathy, would argue against a purely mechanical etiology.

That the manipulative maneuver is associated in some cases of dissection cannot be refuted. The role it plays is probably in the propagation of a pre-existing dissection.

Because the most frequent symptoms of dissection are posterior neck pain or occipital pain, and because this pain can proceed other clinical signs by several weeks, and in light of the fact that most care by doctors of chiropractic directed to the neck are a result of a complaint of pain, suspicion of the possibility of this pathology existing in those patients that present with pain in these areas, should always be held. This is particularly true in those patients relating a history of the above mentioned associated risk factors.

If clinical signs of vertebrobasilar ischemia are evident, they may be subtle, and are frequently associated with the loss of the lower cranial nerves. There may also be signs or symptoms of carotid artery involvement, as these arteries are frequently simultaneously affected.

The manifestation of any signs or symptoms of vertebrobasilar ischemia, either during or following cervical adjustment, is a sign to discontinue care immediately and to refer the patient for a work-up of this pathology, so that appropriate measures can be taken to prevent further ischemic events, and any morbidity or mortality that may occur as a consequence.

While many doctors of chiropractic may never experience a patient with this pathology, we must be diligent to nonetheless keep the possibility of this diagnosis in mind. For it is often the case, that only with a high degree of suspicion, will the diagnosis be made.

Future experience by health care providers will help to more clearly define this pathology. Until that

time, it would appear that an understanding of cervicocephalic artery dissection as a pathology and diligence in its diagnosis can help prevent serious sequela in our patients.

References

1. Yamaura A, Watanabe Y, Naokatsu S: Dissecting aneurysms of the intracranial vertebral artery. *J Neurosurgery* 72: 183-188, 1990.
2. Kitanaka C, Sasaki T, Eguchi T, Teraoka A, Nakane M, Hoya K: Intracranial vertebral artery dissections: Clinical, Radiological Features, and Surgical Considerations. *J Neurosurgery* 34: 620-627, 1994.
3. Kitanaka C, Tanaki J, Kuwahara M, Teraoka A, Sasaki T, Takakura K: Nonsurgical treatment of unruptured intracranial vertebral artery dissection with serial follow-up angiography. *J Neurosurgery* 80: 667-674, 1994.
4. Mas J.L., Henin D, Bousser M.G., Chain F, Hauw J.J.: Dissecting aneurysm of the vertebral artery and cervical manipulation. *Neurology* 39: 512-515, 1989.
5. Josien E: Extracranial vertebral artery dissection: nine cases. *J Neurology* 239: 327-330, 1992.
6. Easton J, Sherman D: Cervical Manipulation and Stroke. *Stroke* 8: 594-597, 1977.
7. Schellhas K, Latchaw R, Wendling L, Gold L: Vertebrobasilar injuries following cervical manipulation. *JAMA* 244: 1450-1452, 1980.
8. Miller R, Burton R: Stroke following Chiropractic manipulation of the spine. *JAMA* 229: 189-190, 1974.
9. Hamann G, Haass A, Kujat C, Felber S, Strittmatter M, Schimrigk K, Piepgras U: Cervicocephalic artery dissections and Chiropractic manipulations. *Lancet* 341: 764-765, 1993.
10. Cashley M: Cervicocephalic artery dissections and Chiropractic manipulations. *Lancet* 341: 1231-1213, 1993.
11. Bohm J: Rebuttal: *Lancet* 341: 1214, 1993.

12. Hamann G, Felber S, Schimrigk K: Cervicocephalic artery dissections and Chiropractic manipulations. *Lancet* 342: 114, 1992.
13. Bowen J, Patz J, Bailey J, Hansen K: Dissection of vertebral artery after cervical trauma. *Lancet* 339: 435-436, 1992.
14. Pratt-Thomas H, Berger K: Cerebellar and spinal injuries after Chiropractic manipulation *JAMA* 133: 600-603, 1947.
15. Kunkle E, Muller J, Odom G: Traumatic brain-stem thrombosis: report of a case and analysis of the mechanism of injury. *Ann Internal Med* 1329-1335, 1950.
16. Green D, Joynt R: Vascular accidents to the brain stem associated with neck manipulation. *JAMA* 82: 522-523, 1959.
17. Ford F, Clark D: Thrombosis of the basilar artery with softenings in the cerebellum and brain stem due to manipulation of the neck. *Bull John Hopkins* pp. 37-42, 1955.
18. Kanshepolsky J, Danielson H, Flynn R: Vertebral artery insufficiency and cerebellar infarct due to manipulation of the neck. *Bull Los Angeles Neuro Soc* pp. 62-63, 1982.
19. Mokri B, Houser O, Sandok B, Piepgras D: Spontaneous dissections of the vertebral arteries. *Neurology* 38: 880-885, 1988.
20. Kitanaka C, Tanaka J, Kuwahara M, Teraoka A: Magnetic resonance imaging study of intracranial vertebrobasilar artery dissections. *Stroke* 25: 571-575, 1994.
21. Zuber M, Meary E, Meder J-F, Mas J-L: Magnetic resonance imaging and dynamic Ct scan in cervical artery dissections. *Stroke* 25: 576-581, 1994.
22. Levy C, Laissy J, Raveau V, Amarenco P, Servois V, Bousser M, Tubiana J: Carotid and vertebral artery dissections: Three dimensional time-of-flight MR angiography and MR imaging versus conventional angiography. *Radiology* 190: 97-103, 1994.
23. Herr R, Call G, Banks D: Vertebral artery dissection from neck flexion during proximal coughing. *Annals of Emergency Med* 21: 88-91, 1992.

24. McCormick G, Halbach V: Recurrent ischemic events in two patients with painless vertebral artery dissection. *Stroke* 24: 598-602, 1993.
25. Schievink W, Mokri B, Michels V, Piepgras D: Familial association of intracranial aneurysms and cervical artery dissections. *Stroke* 22: 1426-1430, 1991.
26. Mokri B, Piepgras D, Wiebers D, Houser W: Familial occurrence of spontaneous dissection of the internal carotid artery. *Stroke* 18: 246-251, 1987.
27. Husni E, Bell H, Storer J: Mechanical occlusion of the vertebral artery. *JAMA* 196: 475-478, 1966.
28. Power T, Hanlon D, Brillman J: Dissections of the cervicocerebral arteries. *Ann Emerg Med* 20: 1032-1035, 1991.
29. Friedman D, Flanders A: Unusual dissection of the proximal vertebral artery: Description of three cases. *AJNR* 13: 283-286, 1992.
30. Youl B.D., Coutellier A, Dubios B, Leger J.M., Bousser M.G.: Three cases of spontaneous extracranial vertebral artery dissection. *Stroke* 21: 618-625, 1990.
31. Linden D, Steinke W, Schwartz A, Hennerici M: Spontaneous vertebral artery dissection initially mimicking myocardial infarction. *Stroke* 23: 1021-1023, 1992.
32. Schievink W, Mokri B, O'Fallon W: Recurrent spontaneous cervical-artery dissection. *N Engl J Med* 330: 393-7, 1994.
33. Mas J.L., Bousser M-G, Hasboun D, Laplane D: Extracranial vertebral artery dissections: A review of 13 cases. *Stroke* 18: 1031-1047, 1987.
34. Sasaki O, Ogawa H, Koike T, Koizumi T, Tanaka R: A clinicopathological study of dissecting aneurysm of the intracranial vertebral artery. *J Neurosurg* 75: 874-882, 1991.
35. Caplan L.R., Baguis G.D., Pessin M.S., D'Alton J, Adelman L.S., DeWitt L.D., Ho K, Izukawa D, Kwan E.S.: Dissection of the intracranial vertebral artery. *Neurology* 38: 868-877, 1988.

36. Caplan L.R., Zarins C.K., Hemmati M: Spontaneous dissection of the extracranial vertebral arteries. *Stroke* 16: 1030-1038, 1985.
37. Jabre A: Subintimal dissection of the vertebral artery in subluxation of the cervical spine. *Neurosurg* 29: 912-91. 1991.
38. Halbach V, Higashida R, Dowd C, Fraser K, Smith T, Teitelbaum G, Wilson C, Heisima G: Endovascular treatment of vertebra artery dissections and pseudoaneurysms. *J Neurosurg* 79: 183-191, 1993.
39. Traflet R, Babaria A, Bell R, Sollenburger S, Doan H.T., Gonzalez C, Mishkin M: Vertebral artery dissection after rapid head turning. *AJNR* 10: 650-651, 1989.

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