

Cervical Spine Manipulation & Vertebrobasilar Artery Stroke: The Modern Perspective

Steven Brown, DC, CICE, Dipl Med Ac
drbrown@brownchiro.com

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For many years, it was considered dogma in the medicolegal community that cervical spine manipulation (CSM) could cause vertebral artery dissection (VAD) and resultant vertebrobasilar artery (VBA) stroke. However, research does not support a causal link between CSM and VAD. Thus, a medicolegal argument that includes CSM causing VAD and resultant VBA stroke is no longer viable.

However, there are two medicolegal arguments by which a Doctor of Chiropractic (DC) may be found liable in cases of CSM and VBA stroke. The first would be failure to diagnose VAD and refer the patient for computed tomography angiography (CTA) imaging and emergency care. DC's often fail to perform the thorough history and physical examination necessary to diagnose and refer a patient with a VAD. Secondly, the research has long supported a mechanism by which CSM could directly cause a VBA stroke. Surprisingly, this mechanism has not gained much traction in the medicolegal community.

Mechanism of VBA Stroke

A tear in the inner lining of a vertebral artery is referred to as a dissection. A dissection may be spontaneous or caused by trauma. A blood clot (or thrombus) formed over the area of dissection may become so large it blocks the vertebral artery, causing a thrombotic VBA stroke. Alternatively, a blood clot formed over the area of dissection may subsequently be dislodged (an embolus) and block a smaller artery that supplies the brain, causing an embolic VBA stroke.

Manipulation & Dissection

Research has shown that the strain to the vertebral artery during CSM is too small to injure a vertebral artery. Vertebral artery strains obtained during CSM are significantly smaller than those obtained during diagnostic and cervical spine range-of-motion (ROM) testing, and are much smaller than failure strains. Researchers have concluded that CSM performed by trained clinicians does not appear to place undue strain on the vertebral artery, and thus is not a factor in VBA injuries.¹

Although there is an association between VBA stroke and Chiropractic visits, there is a similar association between VBA stroke and PCP visits. The two most common symptoms of VAD are neck pain and headache. Patients tend to seek clinical care, Chiropractic and medical, for headache and neck pain caused by VAD. Patients with neck pain and headache reporting VBA stroke after Chiropractic and PCP visits likely had a VAD before their office visit that went undiagnosed.^{2 3 4}

Although research does not support a causal association between CSM and VAD, many clinicians and physicians still assume a causal association between CSM and VAD. Researchers have addressed this phenomenon, “In spite of the very weak data supporting an association between chiropractic neck manipulation and CAD (cervical artery dissection), and even more modest data supporting a causal association, such a relationship is assumed by many clinicians. In fact, this idea seems to enjoy the status of medical dogma. Excellent peer reviewed publications frequently contain statements asserting a causal relationship between cervical manipulation and CAD. We suggest that physicians should exercise caution in ascribing causation to associations in the absence of adequate and reliable data. Medical history offers many examples of relationships that were initially falsely assumed to be causal, and the relationship between CAD and chiropractic neck manipulation may need to be added to this list.” “There is no convincing evidence to support a causal link between chiropractic manipulation and CAD. Belief in a causal link may have significant negative consequences such as numerous episodes of litigation.”⁴

Failure to Diagnose & Refer

Even though it is not possible to prove direct causation of VAD by CSM, failure to diagnose and refer a pre-existing VAD may be present on the part of the DC. VAD causes neck pain and headache which often feels the same as musculoskeletal neck pain and cervicogenic headache. Therefore, many patients seek Chiropractic care for what they assume is musculoskeletal condition in their neck.

A DC is under a duty to diagnose and refer a patient to another licensed health care professional when necessary. When a patient presents with symptoms consistent with VAD, the Doctor of Chiropractic is under a duty to refer for CTA imaging and emergency care. This is the standard of care for the Chiropractic profession.

A common scenario is that the DC fails to diagnose the condition properly and performs CSM on a patient with pre-existing VAD. In most cases of CSM being done in the presence of VAD, manipulation is uncomfortable and ineffective, but there is not an immediate VBA stroke event following manipulation. (We will discuss cases where there is an immediate VBA stroke event following CSM later in this article.)

Musculoskeletal neck pain and cervicogenic headache will normally show improvement immediately after CSM. If CSM is uncomfortable and symptoms do not show improvement, the DC should re-evaluate their diagnosis and consider that the neck pain and headache may not be musculoskeletal in nature. DC's are under a duty to refer for CTA imaging and emergency care if they suspect VAD. If they do not do so, they have breached the standard of care and are liable for failure to diagnose and refer.

Objection to Duty to Diagnose

It may be argued that diagnosis of VAD is outside the scope of practice of a DC. This is not the case. Although Chiropractic scope of practice varies from state to state, a DC is always under a

duty to diagnose, or at least to form a clinical impression, and refer when necessary. Here are a few examples:

Utah Chiropractic Scope of Practice

“Practice of chiropractic” means a practice of a branch of the healing arts: that involves examining, diagnosing, treating, correcting, or prescribing treatment for any human disease ailment, injury, infirmity, deformity, pain, or other condition, or the attempt to do so.⁵

Georgia Chiropractic Scope of Practice

The Doctor of Chiropractic has the responsibility as a primary healthcare provider to examine, establish a diagnosis/clinical impression, render treatment and/or referral, commensurate with his/her findings.⁶

California Scope of Practice

...a duly licensed chiropractor may treat any condition, disease, or injury in any patient, including a pregnant woman, and may diagnose, so long as such treatment or diagnosis is done in a manner consistent with chiropractic methods and techniques and so long as such methods and treatment do not constitute the practice of medicine by exceeding the legal scope of chiropractic practice as set forth in this section.⁷

Objection to Duty to Diagnose

It may be argued that DC's are not trained to diagnose VAD. This is not the case. All accredited Chiropractic colleges train DC's in the history and physical examination procedures necessary to make the diagnosis.⁸ If imaging is needed to confirm the diagnosis, CTA is the imaging study of choice. DC's can order CTA examinations.

However, while diagnosis of VAD is within the scope of practice of a DC, treatment of VAD is outside their scope of practice, and a VBA stroke can occur at any time VAD is present. A VBA stroke could occur in the time it takes for a DC to order CTA imaging. Instead, immediate referral to the ER is indicated, where the patient can receive CTA imaging and emergency care which can prevent a VBA stroke from occurring.

Case Study

A 50-year-old male in Utah sought diagnosis and treatment from a DC complaining of vertigo and balance trouble. Despite the patient having a new chief complaint, and despite not having seen the patient for over three months, the DC did not perform an updated history and physical examination. The patient received CSM with no complications, but also with no relief of vertigo and balance trouble. The DC recommended the patient see their PCP for further evaluation.

The patient saw the Physician Assistant (PA) at his PCP office three days later. The PA felt the patient might be having some sinus trouble causing his dizziness and recommended a Flonase trial. The trial of Flonase did not provide any relief of vertigo and balance trouble.

The patient consulted with a different DC eleven days later, with continued complaints of dizziness and balance trouble. Two days prior, the patient had a severe episode of cold sweats, weakness and dizziness. The DC did not perform an updated history or physical examination, and did not complete any documentation for the date of service. The DC performed CSM. The patient again had no complications following CSM, but again no relief of any symptoms.

The following morning, the patient experienced severe dizziness and lost consciousness. The patient was taken to a hospital where CTA imaging showed VAD and occlusion in the V3 and V4 segments of the left vertebral artery. The patient was diagnosed with a left cerebellar stroke with resultant quadriplegia.

The patient was experiencing symptoms of VAD prior to CSM. All three providers failed to diagnose the VAD and refer the patient for CTA imaging and emergency care. But for the failure to diagnose and refer, the stroke and resultant quadriplegia would not have occurred.

Case Study

A 28-year-old female in Georgia sought diagnosis and treatment from a DC with complaints of right neck pain, headaches in the forehead area, and pain between the shoulder blades. Despite not having seen the patient for ten months, the DC did not perform an updated history and physical examination, and did not order any diagnostic imaging. CSM was performed. Two days later, the patient presented to the ER with complaints of occipital headache, nausea, vomiting and dizziness. CTA imaging of the head and neck was performed. The patient was diagnosed with acute non-hemorrhagic right cerebellar infarct (stroke) as a result of right VAD.

The DC deviated from the standard of care by failing to examine the patient and establish a diagnosis/clinical impression of VAD and refer the patient for CTA imaging and emergency care. If this patient had seen a Medical Doctor (MD) who failed to diagnose the VAD, and then the patient had a VBA stroke after the office visit, the MD would have been charged with failure to diagnose and refer. The standard of care for a DC in these cases is the same as the standard of care for an MD. The DC is under a duty to diagnose and refer.

Case Study

A male in his late 30's developed neck pain while exercising. The patient also had a history of migraine headaches, which had recently changed in nature. The patient sought diagnosis and treatment from a DC three weeks after the onset of symptoms. During CSM, the patient developed nausea, vomiting, and blurred vision. At the ER, imaging demonstrated VAD and VBA stroke.

Plaintiff argued that the patient did not have symptoms of VAD or VBA stroke symptoms prior to the CSM, and did have those symptoms after CSM, and therefore a causal relationship existed. Defense argued that a proximate relationship in and of itself is not enough to establish causation. There was a verdict for the defense. As noted earlier, a direct cause and effect relationship between cervical spine manipulation and vertebral artery stroke is not established.

However, the first symptom of VAD is neck pain. Another symptom of VAD is changes in the nature of migraine headaches. This patient did have symptoms of VAD prior to the CSM, and the DC failed to diagnose and refer the patient for emergency care. The plaintiff lost this case because they argued direct causation, not failure to diagnose and refer.

Why would the plaintiff not argue that the DC was responsible to diagnose the VAD and refer the patient for emergency care? If this patient had seen an MD who failed to diagnose the condition, and then the patient had a stroke after the MD office visit, the MD would have been charged with failure to diagnose and refer. The standard of care for the DC in this case is the same as the standard of care for an MD.

Mechanism of Direct Causation

When a DC fails to diagnose VAD and proceeds with CSM, the research supports a mechanism by which CSM could directly cause VBA stroke. Although CSM has not been shown to cause VAD, CSM is contraindicated in the presence of VAD.⁹ In the presence of VAD, CSM may exacerbate VAD and result in VBA stroke. This could happen under the following circumstances:

1. There is VAD present before CSM. This can be determined by reviewing the medical records. As the two most common symptoms of VAD are neck pain and headache, many patients visit a DC with neck pain and headache that they assume is musculoskeletal. DC's often fail to perform the thorough history taking and physical examination necessary to diagnose VAD.
2. There is a close temporal relationship between the CSM and the onset of ischemic VBA stroke symptoms.

There is a correlation between the level of the CSM and location of the VAD on CTA imaging, and on autopsy examination if the patient is deceased as a result of VBA stroke. Under the above circumstances, CSM may exacerbate VAD and result in VBA stroke. It is unlikely that a pre-existing VAD, which was stable prior to CSM, coincidentally evolved into VBA stroke during or soon after CSM.

VAD is not destined to evolve into VBA stroke. Research shows that most dissections of the vertebral arteries heal spontaneously and especially, extracranial vertebral artery dissections generally carry a good prognosis.¹⁰

The Healthy Vertebral Artery

While research does not show that CSM could result in VBA stroke, the research applies to patients with a healthy vertebral artery, not a patient with VAD. Researchers are careful to make this point. For example:

“Our data suggest that the mechanical strain produced by SM (spinal manipulation) seems to be innocuous to the joints and surrounding tissues in healthy subjects.”¹¹

“There were no significant changes in blood flow or velocity in the vertebral arteries of healthy young male adults after various head positions and cervical spine manipulations.”¹²

“Therefore, we conclude that cervical spinal manipulations, as tested here, are safe from a mechanical point of view for normal, healthy VA (vertebral artery).”¹

The Unhealthy Vertebral Artery

For many years, research has supported the opinion that CSM may exacerbate VAD and result in VBA stroke. For example:

“However, the current study does not exclude cervical manipulation as a possible cause or contributory factor in the occurrence of VBA stroke.”³

“Awareness of the non-specific symptoms of VAD is important because SMT (spinal manipulative therapy) could exacerbate the condition and lead to complications such as stroke.”¹³

“Physical triggers, including SMT, can serve as plausible final link between the underlying disease and stroke (for instance, in case of arterial dissection with existing connective tissue weakness)”.¹⁴

“We have not ruled out neck manipulation as a potential cause of some VBA strokes”. “It might also be possible that chiropractic manipulation, or even simple range-of-motion examination by any practitioner, could result in a thromboembolic event in a patient with a pre-existing vertebral artery dissection.”²

“No cause-and-effect relationship has been established between cervical spine manipulation and CAD, but it seems that cervical manipulation may be capable of triggering dissection in a susceptible patient or contributing to the evolution of an already existing CAD.”¹⁵

“In some cases, neck pain is the only sign of a vertebral artery dissection, motivating a person to seek chiropractic treatment. In this case, cervical manipulation could trigger a dramatic brain stem stroke.”¹⁶

“Thus, cervical pain that precedes and motivates chiropractic cervical manipulation may be the first symptom of a hitherto unrecognized spontaneous (or traumatic) dissection. In such a case, cervical manipulation would precipitate stroke by either worsening arterial damage, leading to positional occlusion of an already narrowed artery, or dislodging an intraluminal thrombus.”¹⁷

Cervical Spine ROM Examination

Cervical spine ROM examination is also contraindicated in the presence of VAD. Cervical spine ROM examination could result in VBA stroke in a patient with VAD.²

Researchers have found that cervical spine ROM examination causes more vertebral artery strain than CSM. Therefore, cervical spine ROM examination is even more likely to exacerbate VAD than a CSM.¹

History taking, especially regarding the time of symptom onset, is the single most important factor for detecting subtle symptoms of VAD.¹⁸ If the history taking indicates possible VAD, then not only is CSM contraindicated, cervical spine ROM examination is also contraindicated.

Physical Medicine Modalities

Medicolegal professionals tend to fixate on CSM in VBA stroke cases involving a DC. However, DC's also perform physical medicine modalities that are contraindicated in the presence of VAD. A few examples:

Electric stimulation to the cervical paraspinal and trapezius muscles is contraindicated in the presence of thrombosis (blood clotting), such as VAD. Therapeutic ultrasound to the cervical paraspinal and trapezius muscles is contraindicated in the presence of arterial disease, such as VAD. Cervical spine mechanical traction is contraindicated in the presence of vascular compromise, such as VAD.¹⁹

Case Study

A 34-year-old female sought diagnosis and treatment from a DC in California with constant, severe, worsening, dull, left craniocervical pain, left headache, and nausea that was not relieved by anything, affected all her daily activities, and was the result of injury five days earlier. The patient had no history of this type of pain, and no history of migraines. The DC failed to perform the thorough history taking and physical examination necessary to diagnose VAD.

The DC misdiagnosed the patient with a migraine, and performed cervical spine ROM examination, CSM to the C1 level, electric stimulation, therapeutic ultrasound, and cervical spine mechanical traction on the patient in the presence of VAD.

The patient suffered a VBA stroke soon after and died. As evidenced by the medical records, the extracranial VAD had been present and stable for a week. CTA imaging and autopsy revealed the VAD was at the C1-C2 level, the same level as CSM.

The CSM did not cause the VAD. However, there was failure to diagnose the VAD and refer for CT angiography and emergency care. CSM, cervical spine ROM examination, and physical medicine modalities performed by the DC exacerbated the VAD and caused it to evolve into a VBA stroke.

Case Study

A 16-year-old male presented to a DC for diagnosis and treatment of neck pain following a snowboarding incident. The patient was an avid snowboard enthusiast and would develop occasional musculoskeletal traumas. Following CSM the patient developed nausea, vomiting,

and dizziness. The patient was taken to a nearby ER where imaging demonstrated VAD and VBA stroke.

Plaintiff's theory in this case was that the DC was negligent and it was the CSM which produced the VAD and subsequent VBA stroke. The defense theory was that this individual had developed neurologic deficits prior to the first visit to the DC. This theory was based on the intake questionnaire the patient completed upon arriving at the DC's office. The patient wrote that the cause of his neck pain was an event that occurred greater than one year prior to the DC visit. Further, the patient suffered difficulty completing his name, signature, and date of birth on the questionnaire. It was clearly demonstrated that this individual had developed symptoms of VAD and VBA stroke prior to the first visit with the DC.

Although the CSM did not cause the pre-existing VAD, or any previous VBA strokes, it did cause the VBA stroke that occurred in the DC's office. This case was settled.

History Taking

These cases all have in common the absence of a thorough history taking and physical examination by the DC. In each case, if the DC had done a thorough history and physical examination, the patient's injuries could have been avoided.

Researchers stress the importance of taking a proper history: "History taking, especially regarding the time of symptom onset, is the single most important factor for detecting subtle symptoms of CAD; thus, primary care clinicians and, especially, manual therapists should dedicate enough time during the first consultation to allow for thorough history taking and physical examination. During history taking, follow-up of the patient's answers in relation to his or her (new) neck pain and/or headache is extremely important to obtain sufficient knowledge and understanding, and one must not accept a simple yes or no answer. In cases with suspicion of high-risk CAD, which contain a combination of several warning signs, there should be an immediate referral to the medical emergency department."¹⁸

Conclusion

Research does not show a causal connection between CSM and VAD in healthy individuals. However, this does not alleviate DC's from liability in cases involving CSM and VBA stroke. DC's may violate the standard of care by failure to diagnose VAD and refer for CTA imaging and emergency care. Furthermore, CSM can result in VBA stroke by way of exacerbation of pre-existing VAD. If cervical spine ROM examination and physical medicine modalities are performed, they may also contribute to the exacerbation of VAD. Thorough history taking and physical examination are essential to diagnosing VAD and making the appropriate referral.

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