Diagnosing Vertebral Artery Dissection: Commentary on the 2014 Mattox Case Report

Steven Brown, DC, Dipl Med Ac[1]

[1]Private Practice, Gilbert, Arizona

Published: 2024
Journal of the International Academy of Neuromusculoskeletal Medicine
Volume 21, Issue 1

INTRODUCTION

In 2014, Mattox et al. published the case report Recognition of Spontaneous Vertebral Artery Dissection Preempting Spinal Manipulative Therapy: A Patient Presenting With Neck Pain and Headache for Chiropractic Care.[1] Although this case report was published ten years ago, it is still referenced today as an example of chiropractic clinical competency. A critical analysis of this case report yields insights into the history, examination, differential diagnosis, and advanced imaging required to diagnose vertebral artery dissection (VAD).

This study is historically important as it was one of the first case reports of VAD published by the chiropractic profession. Other important early case reports of this nature were Kier (2006),[2] Liebich (2014),[3] Tarola (2015),[4] and Futch (2015).[5]

VAD and stroke were discussed in the literature as early as 1947.[6–17] Notably, this topic has been discussed by chiropractic researchers: Haldeman (1999),[18] Haldeman (2002),[12,19] Tuchin (2013),[20] and Brown (2024).[21] The IFOMPT (International Federation of Orthopedic Manual Physical Therapists) Cervical Framework Document, a resource for examination of the cervical region for potential vascular pathology, was first published in 2012.[22] Chaibi and Russell published a risk assessment strategy to exclude VAD in 2019.[23]

DISCUSSION

The Case

Upon subjective examination, the 45-year-old female patient presented with "…upper back/neck pain and stiffness as well as headache and pain in the posterior portion of the right arm down to the elbow of 3 days duration. Her level of discomfort progressed in severity in the 24 hours prior to presentation".

Unilateral neck pain and headache are one of the most common symptoms of VAD. Episodic stress/tension headaches and migraines will normally improve after 72 hours or less, whereas this patient's headache was progressing after 72 hours.[24,25] Cervical spine radicular symptoms can also be a symptom of VAD as vessel wall hematoma in the V2 segment can compress the cervical spine nerve roots.[26] Radicular symptoms can also be caused by cervical spine disc herniation and cervical spine nerve root compression.[27]

The subjective examination indicated the patient had no history of trauma. However, there was no other information provided about the patient's past medical history or risk factors for dissection or stroke. It is unknown if the patient took medications, was a smoker, or used oral contraceptives. It is unknown if the patient's pain was non-responsive to over-the-counter or prescription medications. It is unknown if the patient had a recent acute infection.[28] The report states the patient was "well-nourished", but the patient's BMI (body mass index) was not recorded. A low BMI is a risk factor for dissection, a high BMI is a risk factor for ischemic stroke.

The objective examination consisted of active range of motion, done visually, and palpation. No vital signs, not even blood pressure, were recorded. No orthopedic testing was done. No neurological testing was performed. No reflexes, myotomes, or dermatomes were evaluated. No cranial nerve testing was done. No auscultation for carotid artery bruits was performed. Apparently, no imaging was considered or ordered. Minus neurological examination, it cannot be determined if any of the 5 Ds, 2 Ns, and an A of cerebral ischemia were present (diplopia, dizziness, drop attacks, dysarthria, dysphagia, nausea, numbness, nystagmus, and ataxia).

The assessment was "myofascial pain syndrome." A differential diagnosis including other causes of neck pain, headache, and radicular symptoms was not formulated. Treatment consisted of 4 minutes of therapeutic ultrasound over the suboccipital and posterior cervical musculature, and massage therapy to the same area.

An exact time lapse from treatment to the onset of ischemic symptoms was not noted. However, "within minutes" of treatment the patient became dizzy, reported visual and cognitive disturbances, and had difficulty speaking. She proceeded to lose control of her right leg, which spontaneously assumed a flexion contracture. At this point, the DC suspected vascular etiology and paramedics were summoned.

Right VAD in the V2 segment was noted on CT angiography examination. The case report stated that "Hospital records described transient ischemic attack, but imaging showed no evidence of stroke." Anticoagulation therapy was administered and the patient was discharged without complications after 5 days in the hospital.

According to Easton and Johnston, "TIAs are minor ischemic strokes. These events should be named such, and the term TIA should be retired."[29] Therefore, this author will refer to the cerebrovascular ischemic event that occurred in this case as a stroke.

Weakness of Case Report: Informed Consent

There was no documentation that the DC obtained written or verbal informed consent concerning the risks of physical medicine modalities such as massage therapy and therapeutic ultrasound.[30] While informed consent may have been obtained it was not documented in the case report. In medicolegal settings, this would be tantamount to consent not having been obtained. Such information is relevant to a case report on the clinical management of VAD and should have been included and discussed.

Weakness of Case Report: Misdiagnosis

There was no acknowledgement that the DC misdiagnosed the patient with "myofascial pain syndrome." It cannot be ruled out that this misdiagnosis was the result of inadequate history and physical examination. This patient may have had myofascial pain syndrome, but it was not the primary cause of their symptoms.

Weakness of Case Report: Failure to Diagnose & Refer

There was no acknowledgement that the DC failed to suspect right VAD and refer the patient to medical emergency prior to the occurrence of the stroke.[23] The authors state that it was, "…not possible to distinguish her musculoskeletal symptoms from the those of the VAD". This is incorrect. The symptoms she presented with were the symptoms of the VAD. Headache, neck pain, and radicular pain can be symptoms of many types of conditions, including vascular conditions.

A DC is required to determine the nature of a patient's symptoms. They cannot assume the presence of musculoskeletal symptoms; this is beneath the standard of care. The standard of care requires a thorough history, examination, and differential diagnosis be performed to exclude VAD before performing any treatment.[23] The DC failed in their duty to do so.

The differential diagnosis for the patient's symptoms includes, but is not limited to, cervical spine radiculopathy, cervical spine disc herniation, cervical spine nerve root compression, vertebral artery dissection, and carotid artery dissection. There was no differential diagnosis considering any of these conditions. Had the DC suspected VAD and referred the patient for emergency medical treatment prior to administering massage therapy and therapeutic ultrasound, which may have been contributory, the stroke could have been prevented.

Weakness of Case Report: Causation

There was no acknowledgement that the physical medicine modalities performed by the DC more likely than not caused the stroke. Causation can be established as more likely than not if plausibility, temporality, and lack of a more probable alternative explanation are present.[31] These three criteria are met in this case to establish causation of stroke by these physical medicine modalities:

1. It is plausible that therapeutic ultrasound and massage therapy could exacerbate VAD and cause stroke by a thromboembolic mechanism. Both therapies are contraindicated in the presence of symptoms of potential VAD.[32,33] Bombarding an existing VAD with therapeutic ultrasound for four minutes could putatively dislodge a loosely adherent blood clot causing a thromboembolic stroke.

Neck and head movement associated with seated massage therapy could do the same. The use of a seated massage chair to stabilize the cervical spine and head was not noted. Since the type of massage therapy performed was not documented, it cannot be ruled out that stretching associated with massage therapy treatment may have exacerbated the patient's condition. There are several case reports of a causal association between massage therapy and cervical artery dissection and/or stroke.[34,35,36]

2. There was a close temporal relationship (documented as minutes) between the physical medicine modalities and the stroke. The temporal proximity of the physical medicine treatments and the worsening signs and symptoms was not considered by the authors.

3. There is not a more probable explanation for the cause of the stroke. The VAD had been present and stable for at least 72 hours and only progressed into a stroke within minutes of contraindicated therapies.[31]

Further Analysis

Since we cannot rule out that many readers will fail to go on to the full text article after reading the abstract, especially if they are prone to confirmation bias along the lines that chiropractic care almost never causes stroke, we must comment on the dangerous disinformation provided by the abstract. It states: "A 45-year-old otherwise healthy female presented for evaluation and treatment of neck pain and headache. Within minutes, non-specific musculoskeletal symptoms progressed to neurological deficits, including limb ataxia and cognitive disturbances." The authors fail to mention that the neurological deficits began after the subjective and objective examination and "within minutes" of contraindicated therapies. The abstract implicitly, without stating as such, suggests the neurological deficits began before any evaluation or treatment was provided. It is unfortunate that the treating doctor did not properly examine the patient for a condition that could lead to such deficits.

The abstract states: "We suggest that early recognition and emergent referral for this patient avoided potential exacerbation of an evolving pre-existing condition and resulted in timely anticoagulation treatment." However, the "early" recognition and emergent referral was not early enough to avoid the stroke. Exacerbation of a pre-existing condition is actually what happened, rather than avoided. Stroke following contraindicated therapies is as concerning as stroke following contraindicated spinal manipulation.

The authors state: "Neck pain and headache in such a case could easily be mistaken as musculoskeletal in origin, such as the myofascial pain syndrome." This is misleading. This patient presented with more than simply non-specific neck pain and headache. Three days of progressively worsening unilateral neck pain, headache, and radicular symptoms is a different clinical picture than "neck pain and headache". Chiropractic students are taught to consider that a headache different from previous headaches, such as a headache worsening after several days, is a red flag warning against treatment without proper evaluation.

The authors state: "Most clinicians, whether medical or practitioners using SMT [spinal manipulative therapy], when faced with VAD in progress aren't aware that non-specific symptoms such as neck pain and headache may be the only symptoms." However, as accredited medical and chiropractic graduate and postgraduate programs teach that non-specific symptoms such as neck pain and headache may be the only symptoms of VAD, this statement lacks plausibility.

The authors state, "Awareness of the non-specific symptoms of VAD is important because SMT could exacerbate the condition and lead to complications such as stroke." This is true.[21] However, it is also true that therapeutic ultrasound and massage therapy could exacerbate the condition and lead to complications such as stroke. The VAD may have been present but stable for at least three days prior to the therapeutic ultrasound and massage therapy treatment, and only developed into a stroke within minutes of those treatments. Had the authors not provided therapy, the patient had an excellent chance of healing on his or her own: "Most dissections of the vertebral arteries heal spontaneously and especially, extracranial VADs generally carry a good prognosis.[37]

The title of the case report is misleading and factually incorrect. The treating doctor of chiropractic did not recognize the would-be spontaneous VAD. They recognized the stroke and neurological deficits the patient had within minutes of contraindicated therapies. Spinal manipulation was not somehow preempted by astute recognition of "spontaneous" VAD. SMT was preempted by recognition of iatrogenic stroke following contraindicated therapies performed after inadequate patient evaluation.

Bias Against Cervical Spine Manipulation

If this patient had suffered the same neurological deficits within minutes of cervical spine manipulation, as opposed to within minutes of therapeutic ultrasound and massage therapy, there would likely have been a lawsuit against the DC and this case report would not have been published due to the malpractice case. The treating doctor was fortunate that the patient did not appreciate the likely causal connection between the stroke and the treatment.

Strength of Case Report

A strength of this case report is that it was published in the first place. The chiropractic profession does not normally publish case reports of clinical case management resulting in stroke. This report is useful in an academic setting to teach the importance of a thorough history, examination, differential diagnosis, and advanced imaging. Other professions, such as physical therapy, have published case reports of clinical case management resulting in stroke.[38]

CONCLUSION

According to the information presented in the case report, the DC may have breached the standard of care for the chiropractic profession on four counts. The DC could have been held liable for:

1. Failure to obtain informed consent to the risks of physical medicine modalities.

2. Mistaking right VAD as myofascial pain syndrome.

3. Failure to diagnose and refer a right VAD for concurrent medical evaluation.

4. Causation of thromboembolic stroke by contraindicated therapies performed in the presence of a right VAD.

This case report shows it is essential for DCs to form a differential diagnosis and order the proper advanced imaging when indicated. DCs are under a duty to diagnose and refer out non-neuromusculoskeletal conditions such as VAD lest a cerebrovascular accident occur.

Very few DCs encounter VAD in their clinical internship during their graduate education. Chiropractic post-graduate residency opportunities in the area of vascular disorders are also limited.[39,40] However, patients do present to DC's with neck pain, headache, and radicular symptoms as a result of vascular conditions. Thus, it is essential that DCs take post-graduate continuing education in the diagnosis of vascular disorders. In order to train for the diagnosis and referral of non-neuromusculoskeletal conditions, hospital-based residencies for DCs have been recommended.[39,40]

COMPETING INTERESTS

The author declares no competing interests.

REFERENCES

1. Mattox R, Smith LW, Kettner NW. Recognition of spontaneous vertebral artery dissection preempting spinal manipulative therapy: a patient presenting with neck pain and headache for chiropractic care. *J Chiropr Med*. 2014 Jun;13(2):90–5.

2. Kier AL, McCarthy PW. Cerebrovascular accident without chiropractic manipulation: a case report. *J Manipulative Physiol Ther*. 2006 May;29(4):330–5.

3. Liebich JM, Reinke TS. Presentation of an 85-year-old woman with musculoskeletal pain to a chiropractic clinic: a case of ischemic stroke. *J Chiropr Med*. 2014 Mar;13(1):49–54.

4. Tarola G, Phillips RB. Chiropractic Response to a Spontaneous Vertebral Artery Dissection. *J Chiropr Med*. 2015 Sep;14(3):183–90.

5. Futch D, Schneider MJ, Murphy D, Grayev A. Vertebral artery dissection in evolution found during chiropractic examination. *BMJ Case Rep*. 2015 Nov 12;2015:bcr2015212568.

6. Smith WS, Johnston SC, Skalabrin EJ, Weaver M, Azari P, Albers GW, et al. Spinal manipulative therapy is an independent risk factor for vertebral artery dissection. *Neurology*. 2003 May 13;60(9):1424–8.

7. Pratt-Thomas HR, Berger KE. Cerebellar and spinal injuries after chiropractic manipulation. *J Am Med Assoc*. 1947 Mar 1;133(9):600–3.

8. Kennell KA, Daghfal MM, Patel SG, DeSanto JR, Waterman GS, Bertino RE. Cervical artery dissection related to chiropractic manipulation: One institution's experience. *J Fam Pract*. 2017 Sep;66(9):556–62.

9. Turner RC, Lucke-Wold BP, Boo S, Rosen CL, Sedney CL. The potential dangers of neck manipulation & risk for dissection and devastating stroke: An illustrative case & review of the literature. *Biomed Res Rev*. 2018;2(1).

10. Terrett AGJ. Current concepts in vertebrobasilar complications following spinal manipulation. 2nd ed. West Des Moines, Iowa: NCMIC; 2001.

11. Haldeman S, Carey P, Townsend M, Papadopoulos C. Arterial dissections following cervical manipulation: the chiropractic experience. *CMAJ*. 2001 Oct 2;165(7):905–6.

12. Haldeman S, Kohlbeck FJ, McGregor M. Unpredictability of cerebrovascular ischemia associated with cervical spine manipulation therapy: a review of sixty-four cases after cervical spine manipulation. *Spine*. 2002 Jan 1;27(1):49–55.

13. Hufnagel A, Hammers A, Schönle PW, Böhm KD, Leonhardt G. Stroke following chiropractic manipulation of the cervical spine. *J Neurol*. 1999 Aug;246(8):683–8.

14. Lee VH, Brown RD, Mandrekar JN, Mokri B. Incidence and outcome of cervical artery dissection: a population-based study. *Neurology*. 2006 Nov 28;67(10):1809–12.

15. Klougart N, Leboeuf-Yde C, Rasmussen LR. Safety in chiropractic practice, Part I; The occurrence of cerebrovascular accidents after manipulation to the neck in Denmark from 1978-1988. *J Manipulative Physiol Ther*. 1996;19(6):371–7.

16. Klougart N, Leboeuf-Yde C, Rasmussen LR. Safety in chiropractic practice. Part II: Treatment to the upper neck and the rate of cerebrovascular incidents. *J Manipulative Physiol Ther*. 1996;19(9):563–9.

17. Reuter U, Hämling M, Kavuk I, Einhäupl KM, Schielke E. Vertebral artery dissections after chiropractic neck manipulation in Germany over three years. J Neurol. 2006 Jun;253(6):724–30.

18. Haldeman S, Kohlbeck FJ, McGregor M. Risk factors and precipitating neck movements causing vertebrobasilar artery dissection after cervical trauma and spinal manipulation. *Spine*. 1999 Apr 15;24(8):785–94.

19. Haldeman S, Kohlbeck FJ, McGregor M. Stroke, cerebral artery dissection, and cervical spine manipulation therapy. *J Neurol*. 2002 Aug;249(8):1098–104.

20. Tuchin P. Chiropractic and stroke: association or causation? *Int J Clin Pract*. 2013 Sep;67(9):825–33.

21. Brown SP. Plausible Mechanisms of Causation of Immediate Stroke by Cervical Spine Manipulation: A Narrative Review. *Cureus*. 2024 Mar;16(3): e56565. doi:10.7759/cureus.56565

22. Rushton A, Carlesso LC, Flynn T, Hing WA, Rubinstein SM, Vogel S, et al. International Framework for Examination of the Cervical Region for Potential of Vascular Pathologies of the Neck Prior to Musculoskeletal Intervention: International IFOMPT Cervical Framework. *J Orthop Sports Phys Ther*. 2023 Jan;53(1):7–22.

23. Chaibi A, Russell MB. A risk-benefit assessment strategy to exclude cervical artery dissection in spinal manual-therapy: a comprehensive review. *Ann Med*. 2019 Mar;51(2):118–27.

24. International Headache Society. Headache Classification Committee of the International Headache Society (IHS) The International Classification of Headache Disorders, 3rd edition. *Cephalalgia*. 2018 Jan;38(1):1–211.

25. Kropp P. Handbook of Clinical Neurology: Headache: Chapter 28: Tension-type headache: introduction and diagnostic criteria. Elsevier; 2011. (3; vol. 97).

26. Silbert BI, Khangure M, Silbert PL. Vertebral artery dissection as a cause of cervical radiculopathy. *Asian Spine J*. 2013 Dec;7(4):335–8.

27. Peterson CK, Schmid C, Leemann S, Anklin B, Humphreys BK. Outcomes from magnetic resonance imaging-confirmed symptomatic cervical disk herniation patients treated with high-velocity, low-amplitude spinal manipulative therapy: a prospective cohort study with 3-month follow-up. *J Manipulative Physiol Ther*. 2013 Oct;36(8):461–7.

28. Demetrious JS. Spontaneous cervical artery dissection: a fluoroquinolone induced connective tissue disorder? *Chiropr Man Therap*. 2018;26:22.

29. Easton JD, Johnston SC. Time to Retire the Concept of Transient Ischemic Attack. *JAMA*. 2022 Mar 1;327(9):813–4.

30. Lehman JJ, Conwell TD, Sherman PR. Should the chiropractic profession embrace the doctrine of informed consent? *J Chiropr Med*. 2008 Sep;7(3):107–14.

31. Freeman MD. A Practicable and Systematic Approach to Medicolegal Causation. *Orthopedics*. 2018 Mar 1;41(2):70–2.

32. Batavia M. Contraindications for therapeutic massage: do sources agree? *Journal of Bodywork and Movement Therapies*. 2004 Jan;8(1):48–57.

33. Batavia M. Contraindications for superficial heat and therapeutic ultrasound: do sources agree? *Arch Phys Med Rehabil*. 2004 Jun;85(6):1006–12.

34. Chen WJ, Qiao HY, Fang GT, Zhong X. Vertebral Artery Dissection Probably Caused by Massage: A Case Report. *Chin Med Sci J*. 2019 Mar 30;34(1):65–8.

35. Yap T, Feng L, Xu D, Zhang J. A near-fatal consequence of chiropractor massage: massive stroke from carotid arterial dissection and bilateral vertebral arterial oedema. *BMJ Case Rep*. 2021 Aug 6;14(8):e243976.

36. Kaur J, Singla M, Singh G, Singh G. Frequent neck massage leading to bilateral anterior cerebral artery infarction. *BMJ Case Rep*. 2017 Nov 4;2017:bcr2017222169, bcr-2017–222169.

37. Park KW, Park JS, Hwang SC, Im SB, Shin WH, Kim BT. Vertebral artery dissection: natural history, clinical features and therapeutic considerations. *J Korean Neurosurg Soc*. 2008 Sep;44(3):109–15.

38. Hutting N, Wilbrink W, Taylor A, Kerry R. Identifying vascular pathologies or flow limitations: Important aspects in the clinical reasoning process. *Musculoskelet Sci Pract*. 2021 Jun;53:102343.

39. Wyatt LH, Perle SM, Murphy DR, Hyde TE. The necessary future of chiropractic education: a North American perspective. *Chiropr Osteopat*. 2005 Jul 7;13:10.

40. Murphy DR, Schneider MJ, Seaman DR, Perle SM, Nelson CF. How can chiropractic become a respected mainstream profession? The example of podiatry. *Chiropr Osteopat*. 2008 Aug 29;16:10.