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Review

Review of nine malpractice cases with allegations of causation of cervical artery dissection by cervical spine manipulation: No evidence for causation

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ABSTRACT

Research shows no convincing evidence to support a causal link between cervical spine manipulation (CSM) and cervical artery dissection (CAD). Researchers have proposed that a belief in a causal link may have significant negative consequences such as numerous episodes of litigation. The objective of this study was to review 10 malpractice cases for evidence of unnecessary litigation due to a belief in a causal link between CSM and CAD.

A Google Scholar Case Law search from 1989 to 2024 was conducted to identify the 10 most recent English-language reports of malpractice cases involving an allegation that CSM caused CAD. Although our objective was to review 10 cases, only 9 cases were found.

In all cases, causation of CAD by CSM was not supported by the evidence. In 4 out 9 cases reviewed, causation of stroke by CSM was supported by the evidence. In all 9 cases reviewed, failure to diagnose an existing CAD was more likely than not but was not alleged.

We conclude that belief in a causal link between CSM and CAD does have negative consequences such as unnecessary litigation. In all 9 cases reviewed, allegations of failure to diagnose an existing CAD would have been more likely to result in a settlement without need for a trial.

1. Introduction

In a 2016 systematic literature review and meta-analysis, Church et al. found no convincing evidence that cervical spine manipulation (CSM) can cause cervical artery dissection (CAD).¹ The authors concluded that the known association of neck pain both with CAD and with CSM may explain the relationship between CSM and CAD. The most common symptoms of CAD are neck pain and/or headache which prompt patients to seek CSM. Numerous other studies concur with and support their conclusions.^{2–8}

Church et al. also noted that although research shows no convincing evidence to support a causal link between CSM and CAD, a belief in a causal link persists.¹ The authors went on to propose that this continued belief in a causal link may have significant negative consequences such as numerous episodes of litigation.

Most chiropractic malpractice cases involving CAD also involve stroke. It is commonly alleged that CSM can cause CAD and stroke. Although there is no convincing evidence that CSM can cause CAD, there are plausible mechanisms of causation of stroke by CSM.⁹ If CSM is performed in the presence of existing CAD, the sudden neck and head movement from CSM may dislodge a loosely adherent cervical artery blood clot causing thromboembolic stroke, or suddenly reposition an already large cervical artery blood clot causing thrombotic stroke.^{10,11} These strokes would be of immediate onset, with ischemic symptoms occurring within seconds or minutes.

1.1. Objectives

The objective of this study was to test the hypothesis of Church et al. that belief in a causal link between CSM and CAD may result in numerous episodes of litigation. We aimed to meet this objective by searching for 10 malpractice cases of stroke following CSM and evaluating for the following criteria (Table 1):

1.2. Methods

A Google Scholar Case Law search from 1989 to 2024 was conducted to identify the 10 most recent English-language court opinions involving an allegation that CSM caused CAD. The significant research on a causal relationship of CSM, CAD and stroke began to published in 1989.⁹ Searching since 1989 ensured that the attorneys and experts for the cases had access to this research. Search terms were "chiropractic", "dissection", and "stroke". Our search yielded 58 results.

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1.3. Inclusion/exclusion selection criteria to be included in our study were:

- 1. Court opinions were included if the Plaintiff was a patient alleging that the Defendant, a health care practitioner, caused CAD by way of performing CSM.
- 2. Court opinions were excluded if they did not contain sufficient case information to evaluate causation of CAD by CSM.

2. Results

Although our objective was to review 10 cases, only 9 cases were found that met the inclusion/exclusion criteria (Table 2).

3. Review

3.1. Case 1: Goldstein v. Berenbaum¹²

Plaintiff presented to a chiropractic physician in November 2017. The Defendant performed CSM, which did not cause any pain during or after the treatment. Plaintiff was diagnosed with bilateral vertebral artery dissections and stroke in early December 2017.

The Plaintiff alleged that CSM performed in November 2017 proximately caused the bilateral VADs and stroke diagnosed in early December 2017. The Plaintiff moved for summary judgement which was denied in this court opinion. The matter was remanded for a jury trial. The outcome of the case had not been decided at the time of the court opinion.

3.1.1. Causation of cervical artery dissection

It is not likely that the bilateral VAD was caused by the CSM. The immediate consequence of VAD from CSM would be sudden neck pain and/or headache, a brief syncope, and perhaps nausea, vertigo, and tinnitus.²¹ The Plaintiff did not report pain or other symptoms during or after the CSM in November 2017.

Two Plaintiff experts agreed that imaging obtained in October 2017 demonstrated the Plaintiff had already suffered a right VAD prior to CSM in November 2017. They also agreed that imaging done in December 2017 demonstrated that the left VAD occurred after CSM in November 2017. Both experts opined that the injuries depicted in the October 2017 imaging through the December 2017 imaging show that there was no change, worsening, advancement or progression of the injuries in the area.

3.1.2. Causation of stroke

It is not likely that CSM caused the stroke. Stroke did not occur immediately after the November 2017 CSM, it was not diagnosed until early December 2017. There are plausible mechanisms of causation for immediate stroke after CSM.⁹ However, there are no plausible mechanisms of causation for a non-immediate stroke after CSM.⁹

3.1.3. Failure to diagnose and refer cervical artery dissection

It is more likely than not that the Defendant failed to diagnose and refer an existing right VAD to medical emergency. The Plaintiff failed to argue a case of failure to diagnose and refer an existing right VAD.

Table 2

	Summary of	f the 9	cases	that	met	incl	usion/	excl	lusion	criteria	ł
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Case #	Year	Case	State	Country
"				
1	2024	Goldstein v. Berenbaum ¹²	New York	USA
2	2023	Brutosky v. Stinner ¹³	New Jersey	USA
3	2023	Thomas v. Crawford ¹⁴	Louisiana	USA
4	2023	Nusbaum v. Enlighten Family	Michigan	USA
		Chiropractic ¹⁵		
5	2020	Collins v. Juergens ¹⁶	Washington	USA
6	2020	Soucy v. Gilbertson ¹⁷	Washington	USA
7	2015	Jackson v. Gladdis ¹⁸	Kentucky	USA
8	2013	Bell v. Willis ¹⁹	Pennsylvania	USA
9	2012	Felton v. Lovett ²⁰	Texas	USA

3.2. Case 2: Brutosky v. Stinner¹³

Plaintiff presented to a chiropractic physician with neck and head pain. Within weeks of a CSM procedure, the patient suffered an embolic stroke because of CAD. The patient had a family history of stroke.

The Plaintiff moved for partial summary judgement which was granted in part and denied in part in this court opinion. The outcome of the case had not been decided at the time of the court opinion.

3.2.1. Causation of cervical artery dissection

It is not likely that the CAD was caused by CSM. The immediate consequence of CAD from CSM would be sudden neck pain and/or headache, a brief syncope, and perhaps nausea, vertigo, and tinnitus.²¹ There was no documentation of these symptoms after CSM. The most common symptoms of CAD, neck and head pain, were present before CSM.

3.2.2. Causation of stroke

It is not likely that CSM caused the stroke. Stroke did not occur immediately after CSM. In fact, it did not occur until weeks later. There is no plausible mechanism of causation for a non-immediate stroke after CSM. 9

3.2.3. Failure to diagnose and refer cervical artery dissection

It is more likely than not that the Defendant failed to diagnose and refer an existing CAD to medical emergency. The Plaintiff failed to argue a case of failure to diagnose and refer an existing CAD.

3.3. Case 3: Thomas v. Crawford¹⁴

Plaintiff presented to a chiropractic physician with neck pain. After her third CSM, the Plaintiff immediately began experiencing symptoms of vomiting, dizziness, vision loss, and the inability to control her body, particularly the right side. After a delay, the Defendant's assistant contacted EMS. The Plaintiff was diagnosed with a stroke caused by VAD.

The trial court's grant of a directed verdict in favor of the Defendant was reversed in this court opinion. The case was remanded for further proceedings. The outcome of the case had not been decided at the time of the court opinion.

3.3.1. Causation of cervical artery dissection

It is not likely that the VAD was caused by CSM. The patient suffered an immediate stroke after CSM. In the case of an immediate stroke by CSM, it is more likely than not that VAD was pre-existing.⁹

Table 1

Criteria for evaluation of malpractice cases.

Criteria for Evaluation of Malpractice Cases

1. Was there convincing evidence of a belief in a causal link between CSM and CAD.

2. Was there convincing evidence of causation of stroke by CSM.

3. Was there convincing evidence of an existing CAD prior to CSM, and to determine if an allegation of failure to diagnose an existing CAD was made.

Thromboembolic and thrombotic mechanisms of causation of stroke following CSM require VAD be present prior to the CSM.

3.3.2. Causation of stroke

It is more likely than not that CSM performed in the presence of an existing VAD caused an immediate thromboembolic or thrombotic stroke.⁹

3.3.3. Failure to diagnose and refer cervical artery dissection

As the patient suffered an immediate stroke after CSM, it is more likely than not that the Defendant failed to diagnose and refer an existing VAD to medical emergency.⁹ The Plaintiff failed to argue a case of failure to diagnose and refer an existing VAD.

3.4. Case 4: Nusbaum v. Enlighten Family Chiropractic¹⁵

Plaintiff presented to a chiropractic physician with headache and neck pain. The day after her second CSM, the patient developed numbness in her face, right sided paresthesias, severe headaches and facial weakness, drooling from the right side of her mouth, numbness in the right side of her body, as well as right-sided weakness. Three days later she went to a hospital where she was diagnosed with right VAD and right medullary stroke.

The Plaintiff filed an omnibus motion in limine. The motion was granted in part and denied in part in this court opinion. The outcome of the case had not been decided at the time of the court opinion.

3.4.1. Causation of cervical artery dissection

It is not likely that the VAD was caused by CSM. The patient entered the office with neck pain and headache, the most common symptoms of VAD, prior to any CSM. 13

3.4.2. Causation of stroke

It is not likely that CSM caused the stroke, as the stroke did not occur immediately. The stroke occurred the day after CSM. There is no plausible mechanism of causation of a non-immediate stroke from $\rm CSM.^9$

3.4.3. Failure to diagnose and refer cervical artery dissection

It is more likely than not that the Defendant failed to diagnose and refer an existing VAD to medical emergency.⁹ The Plaintiff failed to argue a case of failure to diagnose and refer an existing VAD.

3.5. Case 5: Collins v. Juergens¹⁶

Plaintiff presented to a chiropractic physician with recurring pain in his left shoulder and arm extending down into his index finger. Even though the Plaintiff had not been seen by the Defendant in over six months, Defendant did not perform a thorough history taking and physical examination. The Defendant performed CSM. The Plaintiff reported some pain during the CSM.

After being treated by the Defendant, the Plaintiff sought care from his primary care physician who diagnosed the patient as having a stroke incident to his recent CSM. Imaging revealed that the Plaintiff had a VAD between the first and second vertebrae. A neurologist diagnosed the Plaintiff as having a left cerebellar stroke caused by his recent CSM.

Plaintiff filed a lawsuit against the Defendant in which he claimed that the CSM caused a VAD and resulted in a stroke. This claim was dismissed on summary judgement and the dismissal was upheld on appeal.

3.5.1. Causation of cervical artery dissection

It is not likely that CSM caused the VAD. The Plaintiff entered the office with symptoms of an existing VAD. Symptoms of VAD can resemble the symptoms of cervical radiculopathy at C5-C6.^{2,22-24} Recurring pain in the left shoulder and arm extending down into the index finger are symptoms of cervical radiculopathy at C5-C6. The

Plaintiff had these symptoms before any CSM was performed.

The immediate consequence of CAD from CSM would be sudden neck pain and/or headache, a brief syncope, and perhaps nausea, vertigo, and tinnitus.²¹ Symptoms of VAD pre-existed the CSM and no additional symptoms immediately following CSM were documented.

3.5.2. Causation of stroke

It is not likely that CSM caused the stroke. There were no symptoms of ischemic stroke documented within seconds or minutes of CSM. In fact, there were no symptoms of ischemic stroke documented in the court opinion. Not by the chiropractic physician or by the two medical physicians. Neck pain is the most common symptom of VAD, it is not an ischemic symptom of left cerebellar stroke. The court opinion does not state when the left cerebellar stroke may have occurred. There was no documentation that it occurred immediately after CSM.

3.5.3. Failure to diagnose and refer cervical artery dissection

It is more likely than not that the Defendant failed to diagnose and refer an existing VAD to medical emergency. The Plaintiff entered the office with symptoms of VAD. The Plaintiff failed to argue a case of failure to diagnose and refer an existing VAD.

This case occurred in the State of Washington. The failure of a chiropractic physician to perform a physical examination as part of formulating a differential diagnosis is a violation of the law in the State of Washington. The Revised Code of the State of Washington states, "As part of a chiropractic differential diagnosis, a chiropractor shall perform a physical examination, which may include diagnostic x-rays, to determine the appropriateness of chiropractic care or the need for referral to other health care providers."²⁵

3.6. Case 6: Soucy v. Gilbertson¹⁷

Plaintiff presented to a chiropractic physician with neck pain. Immediately after CSM, the Plaintiff suffered an ischemic stroke. After a delay, the Defendant called 911. The patient was diagnosed with bilateral VAD, stroke, and fibromuscular dysplasia.

The Plaintiff alleged that the CSM caused the bilateral VAD and the stroke. The jury returned a defense verdict.

3.6.1. Causation of cervical artery dissection

It is not likely that CSM caused the VAD. Fibromuscular dysplasia is a risk factor VAD,² and the Plaintiff entered the office with neck pain, the most common symptom of VAD, before any CSM was performed. The Plaintiff had an immediate stroke after CSM. In the case of an immediate stroke after CSM, it is more likely than not that the VAD pre-existed the CSM.⁹

3.6.2. Causation of stroke

It is more likely than not that CSM performed in the presence of an existing VAD caused an immediate thromboembolic or thrombotic stroke.⁹

3.6.3. Failure to diagnose and refer cervical artery dissection

As the patient suffered an immediate stroke after CSM, it is more likely than not that the Defendant failed to diagnose and refer an existing VAD to medical emergency.⁹ The Plaintiff failed to argue a case of failure to diagnose and refer an existing VAD.

3.7. Case 7: Jackson v. Gladdis¹⁸

Plaintiff presented to a chiropractic physician with neck pain as the result of a motor vehicle accident. After her fourth CSM, the Plaintiff began feeling dizzy and light-headed. The Plaintiff informed the Defendant that she was experiencing nausea and a "spinning feeling," and the Defendant diagnosed her with vertigo. The Defendant helped the Plaintiff to the restroom, where she began vomiting. After failing to

reach the Plaintiff's husband, the Defendant had his office manager transport the Plaintiff to the emergency room. The Defendant did not call 911.

Imaging did not show any evidence of CAD but did show evidence of ischemic stroke. A neurologist told the Plaintiff that she most likely suffered a minor stroke due to a VAD caused by CSM. It is possible to have VAD which is difficult to detect on imaging, or it is possible that the imaging was misread.²⁶

The Plaintiff sued the Defendant, claiming that CSM caused VAD. A jury returned a unanimous verdict for the Defendant and found that the Defendant provided appropriate chiropractic care and treatment to the Plaintiff.

3.7.1. Causation of cervical artery dissection

Imaging was negative for VAD, but the circumstances of the case make it more likely than not that VAD was present before CSM. The Plaintiff entered the office with neck pain, the most common symptom of VAD. The Plaintiff suffered an immediate stroke after CSM, which makes it likely that VAD was present before the CSM. The only two plausible mechanisms of immediate post-manipulative stroke, throm-boembolic and thrombotic, both require that VAD be present before CSM.⁹

3.7.2. Causation of stroke

It is more likely than not that CSM performed in the presence of an existing VAD caused an immediate thromboembolic or thrombotic stroke. 9

3.7.3. Failure to diagnose and refer cervical artery dissection

As the patient suffered an immediate stroke after CSM, it is more likely than not that the Defendant failed to diagnose and refer an existing VAD to medical emergency.⁹ The Plaintiff failed to argue a case of failure to diagnose and refer an existing VAD.

3.8. Case 8: Bell v. Willis¹⁹

Plaintiff presented to two chiropractic physicians with neck pain, headaches and dizziness. The morning after her last CSM, she suffered a VAD and massive stroke. The stroke resulted in a "locked-in" state. The patient died 18 months later due to a massive infection.

The Plaintiff alleged that CSM was the cause of the VAD and the stroke. The jury rendered a defense verdict.

3.8.1. Causation of cervical artery dissection

It is not likely that CSM caused the VAD. The Plaintiff entered the office with the most common symptoms of an existing VAD, neck pain and headaches. The immediate consequence of CAD from CSM would be sudden neck pain and/or headache, a brief syncope, and perhaps nausea, vertigo, and tinnitus.²¹ Symptoms of VAD pre-existed the CSM and no additional symptoms immediately following CSM were documented.

3.8.2. Causation of stroke

It is not likely that CSM caused the stroke. The stroke occurred the morning after her last CSM, there were no symptoms of ischemic stroke documented within seconds or minutes of CSM. The patient had dizziness when presenting for treatment. Dizziness is a symptom of brain ischemia. Therefore, it is more likely than not that the patient was suffering from a mild stroke before she had any CSM.

3.8.3. Failure to diagnose and refer cervical artery dissection

It is more likely than not that the Defendant failed to diagnose and refer an existing VAD to medical emergency. The Plaintiff entered the office with the two most common symptoms of VAD, neck pain and headache. The Plaintiff failed to argue a case of failure to diagnose and refer an existing VAD.

3.9. Case 9: Felton v. Lovett²⁰

Plaintiff presented to a chiropractic physician with neck pain. Defendant obtained a history, x-rayed Plaintiff's cervical spine, and on two occasions, performed CSM. When the treatments did not provide relief, the Plaintiff claimed that the Defendant performed a more forceful manipulation on Plaintiff's third visit. Plaintiff immediately began experiencing blurred vision, nausea, and dizziness. Defendant called an ambulance, which took Plaintiff to the hospital, where doctors determined that he had suffered a stroke resulting from a VAD.

The Plaintiff alleged it was "much more likely than not" that the Plaintiff's VAD resulted from the Defendant's CSM. The jury found in favor of the Defendant on this allegation. The Plaintiff won the case based on failure to obtain Informed Consent to the risk of injury from CSM, not on the allegation that CSM caused the VAD.

3.9.1. Causation of cervical artery dissection

It is not likely that CSM caused the VAD. The Plaintiff entered the office with neck pain, the most common symptom of VAD. The only plausible mechanisms of causation for an immediate stroke from CSM require that VAD be present before CSM.

3.9.2. Causation of stroke

It is more likely than not that CSM caused an immediate thromboembolic or thrombotic stroke from being performed in the presence of an existing VAD.⁹ Ischemic stroke symptoms began immediately with CSM.

3.9.3. Failure to diagnose and refer cervical artery dissection

It is more likely than not that the Defendant failed to diagnose and refer an existing VAD to medical emergency. The Plaintiff entered the office with neck pain, the most common symptom of VAD. The Plaintiff failed to argue a case of failure to diagnose and refer an existing VAD.

4. Discussion of findings

In all cases, allegations of causation of CAD by CSM were not supported by the evidence (Table 3). Bringing these unsupported allegations of causation resulted in unnecessary litigation, as noted by Church et al.¹ In the four most recent cases, the outcome of the case was not in the court opinion. In the latter 5 cases, the allegations of causation of CAD by CSM were not successful.

In 4 out of 9 cases, there was evidence for causation of stroke by CSM (Table 3). Plaintiff attorneys and researchers should consider the possibility of causation of stroke by CSM, even in the absence of causation of CAD by CSM.⁹

In all cases, it was more likely than not that the Defendant failed to diagnose and refer an existing CAD (Table 3). If the Plaintiff had argued that the Defendant failed to diagnose and refer an existing CAD, the case would have been more likely to settle without a trial.

Hartnett et al. found that in chiropractic malpractice cases a higher percentage of settlements has been noted with claims of failure to diagnose compared to claims of aggressive treatment causing injury.²⁷

A review of case reports alleging causation of CAD by CSM showed similar results to the current study.²⁸

Table 3		
Summary	of case	evaluation.

5									
Three Criteria Evaluated	1	2	3	4	5	6	7	8	9
Causation of CAD Causation of Stroke	No No	No No	No Yes	No No	No No	No Yes	No Yes	No No	No Yes
Failure to Diagnose & Refer Existing CAD	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

4.1. Limitations

This is a narrative review, rather than a systematic review. Article screening and data extraction was done by a single author so it is possible that relevant articles may have been missed, or that there may have been errors in extraction.

Documents reviewed consisted of court opinions. It is possible that not all case information was included in the court opinion. A review of additional court opinions could possibly find cases where allegations of CSM causing CAD were successful. The outcome of the four most recent cases was not included in the court opinion as the case was not decided at the time of the court opinion.

Only one legal database, Google Scholar Case Law, was searched. Additional cases could possibly be found by searching additional legal databases such as Verdict Search.

Only nine cases were analyzed. More cases are needed to arrive at a more complete conceptualization of the hypothesis.

5. Conclusions

We conclude that belief in a causal link between CSM and CAD does have negative consequences such as unnecessary litigation. In all 9 cases reviewed, allegations that CSM caused CAD were not supported by the evidence. Four cases showed evidence of causation of stroke by CSM, even in the absence of causation of CAD by CSM. Failure to diagnose and refer an existing CAD was more likely than not in all 9 cases but was not alleged. If the Plaintiff had argued that the Defendant failed to diagnose and refer an existing CAD, the case would have been more likely to settle.

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