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ORIGINAL RESEARCH

Cervical artery dissection related to chiropractic manipulation: One institution's experience

This study suggests that patients considering chiropractic cervical spine manipulation should be advised of the risks of potential arterial dissection and stroke.

ABSTRACT

Purpose ▶ The purpose of this study was to determine the frequency of patients seen at a single institution who were diagnosed with a cervical vessel dissection related to chiropractic neck manipulation.

Methods ▶ We identified cases through a retrospective chart review of patients seen between April 2008 and March 2012 who had a diagnosis of cervical artery dissection following a recent chiropractic manipulation. Relevant imaging studies were reviewed by a board-certified neuroradiologist to confirm the findings of a cervical artery dissection and stroke. We conducted telephone interviews to ascertain the presence of residual symptoms in the affected patients.

Results ▶ Of the 141 patients with cervical artery dissection, 12 had documented chiropractic neck manipulation prior to the onset of the symptoms that led to medical presentation. The 12 patients had a total of 16 cervical artery dissections. All 12 patients developed symptoms of acute stroke. All strokes were confirmed with magnetic resonance imaging or computerized tomography. We obtained follow-up information on 9 patients, 8 of whom had residual symptoms and one of whom died as a result of his injury.

Conclusions ▶ In this case series, 12 patients with newly diagnosed cervical artery dissection(s) had recent chiropractic neck manipulation. Patients who are considering chiropractic cervical manipulation should be informed of the potential risk and be advised to seek immediate medical attention should they develop symptoms.

A prospective randomized controlled study published in 2012 showed chiropractic manipulation is beneficial in the treatment of neck pain compared with medical treatment, but it showed no significant difference between chiropractic manipulation and physical therapy exercises.¹ Although chiropractic manipulation of the cervical spine may be effective, it may also cause harm.

Cerebellar and spinal cord injuries related to cervical chiropractic manipulation were first reported in 1947.² By 1974, there were 12 reported cases.³ Noninvasive imaging has since greatly improved the diagnosis of cervical artery dissection and of stroke,⁴ and cervical artery dissection is now recognized as pathogenic of strokes occurring in association with chiropractic manipulation.⁵

A prospective series published in 2011 reported that, over 4 years, 13 patients were treated at a single institution for cervical ar-

terial dissection following chiropractic treatment.⁶ That so many patients might be seen for this condition in that time frame at a single institution suggests the risk for such injury may be greater than thought. To explore that possibility, we performed a 4-year retrospective review to determine the experience at OSF Saint Francis Medical Center, which is affiliated with the University of Illinois College of Medicine, Peoria.

METHODS

Data sources. After receiving approval by the local institutional review board, we obtained data from the electronic medical records of OSF Saint Francis Medical Center, Peoria, Ill., using Epic (Epic Systems Corporation, Verona, Wis.) and IDX (General Electric Corpo-

ration, Fairfield, Conn.) systems. The records were queried using ICD-9 codes 443.21 and 443.24 to identify patients from April 2008 through March 2012 who had primary or secondary diagnoses of vertebral artery dissection (VAD) or carotid artery dissection (CAD). We reviewed all records of VAD and CAD to identify those that may have been associated with chiropractic manipulation.

Data collection. We abstracted data from 12 patients' charts. Two patients were unavailable for direct contact: one was involved in ongoing litigation, and one had died (although we were able to speak with his wife). We attempted telephone contact with the 10 remaining patients and reached 8.

Data included the symptoms leading to chiropractic manipulation, symptoms following manipulation, timing of onset of

TABLE 1

Demographics, original symptoms, and frequency of chiropractor use

Case #	Sex/age	Original symptoms*	Frequency of chiropractor use	Time from manipulation to development of new symptoms
1	M/32	Chronic neck pain	Occasional	Immediate
2	F/37	Chronic neck pain	Once a month for 15 years	Immediate
3	F/40	Neck pain for a few weeks	Several visits subsequent to onset of pain	Immediate
4	F/22	Motor-vehicle accident (MVA) one month earlier; neck pain and stiffness	Unknown	Immediate
5	F/30	Postpartum neck pain and stiffness	First time	Immediate
6	F/45	Chronic headaches	Regular	Immediate
7	M/45	Chronic neck and back pain post MVA 19 years ago	Occasional	Immediate
8	M/44	Neck stiffness for 2 days; no history of trauma	Unknown	Immediate
9	F/46	Sore neck for a few days	Once or twice a year for past 5 years	Immediate
10	F/27	Chronic neck pain and headaches several years post MVA	First time	Immediate
11	F/29	Neck stiffness and migraines	Once a week for 10 years	2 days
12	F/36	Neck pain and migraines	Regular	2-3 days

*Symptoms that led to chiropractic manipulation.

TABLE 2

Timing of events and outcomes following chiropractic care

Case #	Post chiropractic manipulation symptoms that led patient to seek medical care	Time from symptom onset to medical visit	Outcome*
1	HA, ear and forehead pain, N/V, and blurry vision	Several weeks	Death
2	N/V, dizziness, and visual disturbance	Immediate	Disequilibrium, stubs toes, clumsiness
3	Sensation of pop and onset of neck pain, HA, N/V	Immediate	Unknown
4	New neck pain, N/V	Immediate	Unknown
5	Blurred vision, difficulty speaking and swallowing, right facial paresthesias, and vertigo.	Immediate	Unsteady when eyes closed, right eyelid droop, HAs, dizziness
6	Vertigo and nausea	Immediate	No residual symptoms
7	Visual field defect, nausea, and dizziness	Immediate	Bilateral visual field defects, HAs
8	Weakness in all 4 extremities with numbness, neck pain, and severe posterior HA	Immediate	At 5-7 months post dissection: spasticity of right hand, reduced use of right arm and leg, neck pain, depression, ataxia
9	Neck pain, mild dizziness, and nausea. Two days later, severe eye pain, slurred speech, and syncope	2 days	Left foot weakness, bilateral visual field defects, balance problems requiring use of a cane
10	N/V and severe vertigo	Immediate	Slight limp
11	N/V, near syncope, vertigo, and visual disturbance	Immediate	HAs, left arm weakness
12	Left-sided numbness, clumsiness, tingling, and HA	Immediate	Unknown

HA, headache; N/V, nausea and vomiting.

*All outcomes >1 year post event unless otherwise indicated.

symptoms relative to chiropractic manipulation, identifying information for the treating chiropractor, and residual patient symptoms. We also recorded patients' ages, sex, locations of dissection, and locations of stroke. All dissections and strokes had been diagnosed during the patient's initial hospitalization.

A board-certified radiologist (JRD) with a Certificate of Added Qualification in Neuroradiology (American Board of Medical Specialties) reviewed all pertinent imaging to confirm all dissections and strokes.

RESULTS

The medical record query yielded 141 patients with VAD or CAD, 15 of whom had undergone chiropractic manipulation prior to their presentation. The temporal association between chiropractic manipulation and arterial dissection was equivocal for 3 patients. In 12 patients, there was a verifiable temporal association between chiropractic manipula-

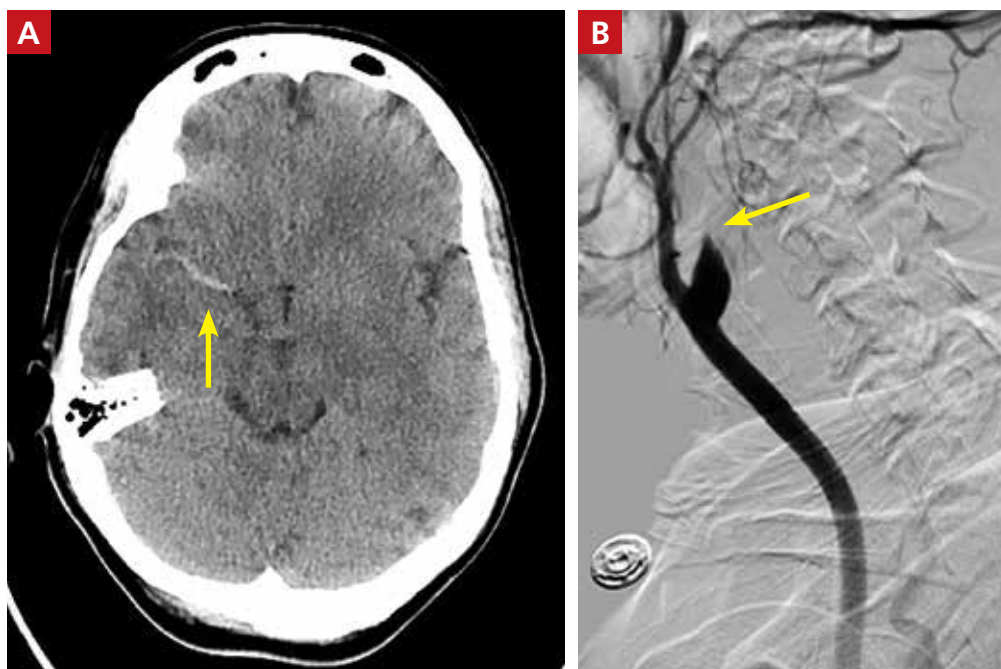
tion and the arterial dissection. Three of the 12 patients were men and 9 were women. Ages ranged from 22 to 46 years, with a mean of 35.3 years.

Acute or chronic neck pain was the most common reason for seeking chiropractic care (TABLE 1). Immediately upon performance of cervical manipulation, 10 of the 12 developed acute symptoms different than those that caused them to seek chiropractic care. Two patients developed symptoms 2 to 3 days post-manipulation. Neither of the 2 had a history of neck trauma within the preceding year. Ten of the 12 patients sought immediate medical attention. Two of the 12 patients sought care when their symptoms became more severe, ranging from 2 days to several weeks later (TABLE 2). The treating chiropractor was identified in 7 cases and was different in each of the 7 cases.

A total of 16 cervical artery dissections, 14 VAD and 2 CAD, were confirmed by computed tomography angiography (CTA),

FIGURE 1

CASE 9: A 46-year-old woman with immediate onset of symptoms following chiropractic manipulation



IMAGES COURTESY OF: OSF SAINT FRANCIS MEDICAL CENTER, PEORIA, ILL.

This patient had scattered right-middle cerebral artery (MCA) infarcts, which led to residual left foot weakness and visual defect necessitating use of a cane. Non-contrast computed tomography (A) showed a hyper-dense clot in the right MCA. Lateral projection on digital subtraction angiography (B) showed proximal internal carotid artery dissection and luminal thrombosis.

magnetic resonance angiography (MRA), or catheter angiography (FIGURE 1). All 12 patients had acute strokes confirmed by MRA or CTA, including 9 in the cerebellum (FIGURE 2), 4 in the cerebrum, 2 in the medulla, and one in the pons.

Long-term outcomes were determined for 9 patients (TABLE 2). One patient's symptoms resolved. Three patients had dizziness, clumsiness, or balance problems; 3 had persistent headaches; 2 had bilateral visual field abnormalities; and one patient walked with a cane, was no longer driving a car, and was on disability. One patient died as a result of his injury. One of the 12 cases was previously described in a case report.⁷

DISCUSSION

Dissection of the cervical arteries is more common than dissection in other arteries of comparable size. This increased risk in the cervical arteries is believed to be due to

their relative mobility and proximity to bony structures.⁴

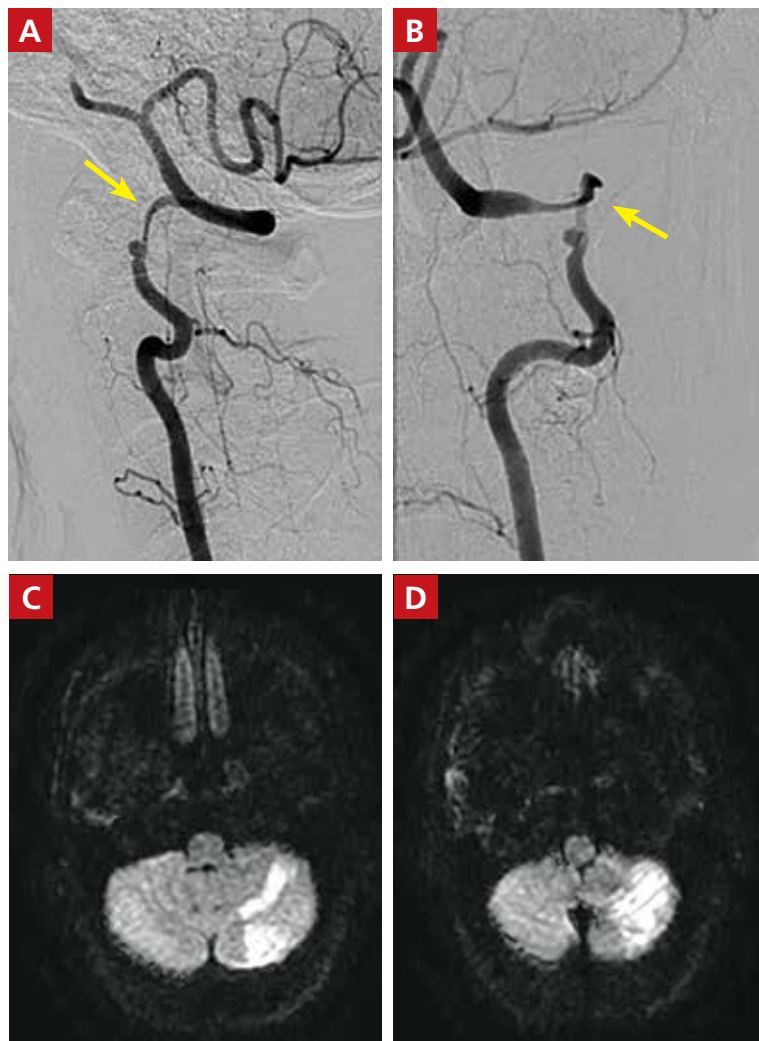
Sudden neck movement, a feature of chiropractic treatment, is one of several known risk factors for 'spontaneous' cervical artery dissection.^{8,9} Symptom onset and stroke may be delayed after a spontaneous cervical artery dissection.¹⁰ Spontaneous dissection more commonly involves the carotid arteries;⁴ however, the vertebral arteries appear more prone to dissection as a consequence of chiropractic manipulation,¹¹ likely due to their relation to the cervical spine.

The vertebral artery runs through foramina in the transverse processes of vertebral bodies C1 through C6 (FIGURE 3). On exiting the C2 transverse process, the vertebral artery has a tortuous course, making several turns over and through adjacent bony structures.¹² The artery is most prone to injury between the entrance to the transverse foramen of C6 and the foramen magnum (V2 and V3 segments).¹³ (The area of highest vulnerability

➤ The Canadian Stroke Consortium has shown a 28% incidence of chiropractic manipulation in cases of cervical artery dissection.

FIGURE 2

CASE 11: A 29-year-old woman who experienced delayed onset of symptoms following manipulation



This patient's neck stiffness and headaches began 2 days after chiropractic manipulation. Antero-posterior and lateral views on digital subtraction angiography (A, B) showed distal left V2 and V3 dissection. Diffusion-weighted magnetic resonance imaging showed acute left cerebellar infarcts (C, D). The patient has residual left arm weakness and headaches.

is the tortuous segment from the transverse foramen of C2 to the foramen magnum.)

Sudden movements of the cervical spine may cause arterial dissection, whether the maneuvers are performed by a physician, a chiropractor, or a physical therapist.¹⁴ Injuries reported in the literature, however, most commonly follow chiropractic manipulation. In our series of 141 dissections, we found no

cases associated with manipulation by other health professionals.

A 2003 study revealed cervical spine manipulation to be an independent and strong risk factor for vertebral artery dissection. The authors believed the relationship was likely causal.⁵ Data from the Canadian Stroke Consortium showed a 28% incidence of chiropractic manipulation in cases of cervical artery dissection.¹⁰

A 2008 study showed an association between vertebrobasilar stroke and chiropractic visits within one month of the vascular event.¹⁵ However, the study also showed an association of similar magnitude between vertebrobasilar stroke and visits to primary care physicians within the prior month. This suggests that cervical manipulation by chiropractors poses no more risk for cervical artery dissection than visits to primary care physicians. However, it is hard to reconcile such a conclusion with other studies, including our own, in which 10 patients developed new symptoms immediately with chiropractic manipulation of their cervical spines.

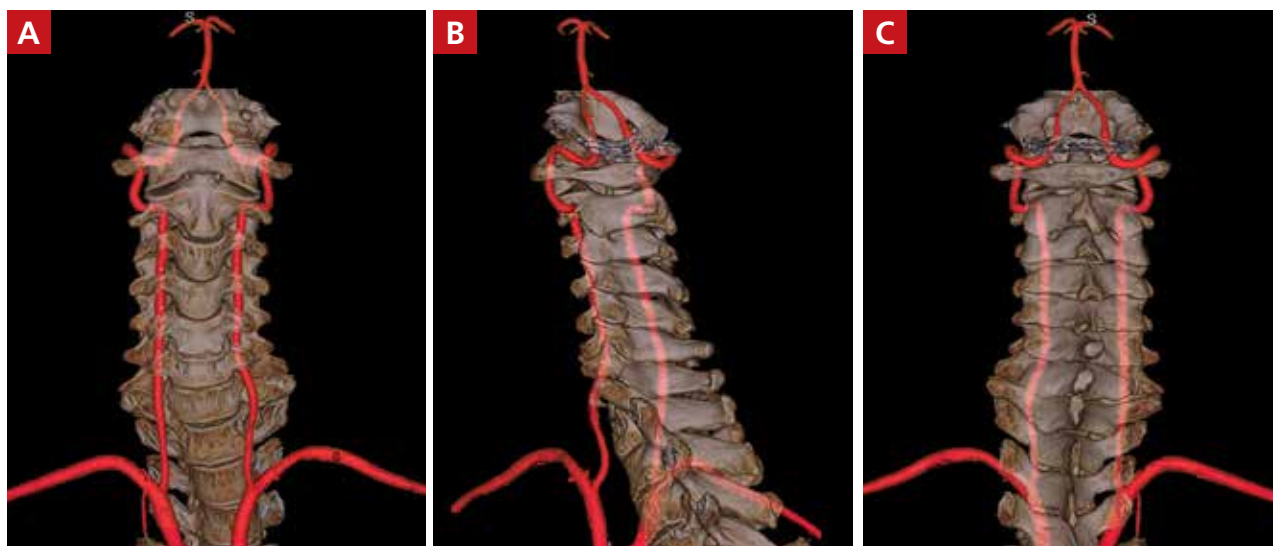
Perhaps the one-month observation period of Cassidy et al was excessive. Many post-manipulation events occur within hours or at most a few days, as would be expected given the hypothesized pathogenic mechanism. Perhaps if they had shortened their interval of study to the preceding 3 days, their findings may have been different.

A recent systematic review and meta-analysis demonstrated a slight association between chiropractic neck manipulation and cervical artery dissection. It stated that the quality of the published literature was very low, and it concluded there was no convincing evidence of causation.¹⁶ The fact that 10 of the 12 patients in our case series demonstrated acute symptoms immediately upon receiving spinal manipulation suggests a possible causal link; however, we agree with the authors of the meta-analysis that the quality of the literature is low.

A recent statement from the American Heart Association/American Stroke Association (and endorsed by the American Association of Neurological Surgeons and the Congress of Neurological Surgeons) has recommended that chiropractors inform pa-

FIGURE 3

Course of the vertebral arteries through the transverse foramina of C1-C6



The vertebral arteries are at increased risk of injury with neck manipulation, likely due to their close association with the cervical spine. Most chiropractic injuries occur within the complex loop of the vertebral arteries from where they exit the transverse foramen of C2 to where they enter the foramen magnum. Frontal view (A); posterior oblique view (B); and posterior view (C).

tients of the statistical association between cervical artery dissection and cervical manipulation.¹⁷ In addition, it is important for chiropractors to be aware of the signs and symptoms of cervical artery dissection and stroke and to assess for these symptoms before performing neck manipulation, as illustrated in a recent case report.¹⁸ Due to the risk of death, patients who experience symptoms consistent with cervical artery dissection after chiropractic manipulation of the cervical spine should be advised to seek medical care immediately.

■ Our case series has several limitations.

The study was retrospective. Existing documentation of associated chiropractic care was often sparse, necessitating phone calls to supplement the information. We believe it is possible that cases may have been missed because of inaccurate medical record documentation, deficits in the interview process concerning chiropractic care at the time of hospitalization, or because information concerning chiropractic care was not recorded in the chart.

A significant portion of our information came through phone contact with several of the patients. In some cases, we relied heavily on their recollection of events that had oc-

curred anytime from a few days to a few years earlier. The accuracy and completeness of the information supplied by patients was not verified, allowing for potential recall bias.

We do not know whether our experience is consistent with that of other areas of the United States. However, the fact that a similar-size hospital in Phoenix reported similar findings suggests the experience may be more widespread.⁶

IMPLICATIONS OF OUR FINDINGS

Over a 4-year period at our institution, 12 patients experienced cervical vessel dissection related to chiropractic neck manipulation. A similar institution in another part of the country had previously described 13 such cases. The patients at both institutions were relatively young and incurred substantial residual morbidity. A single patient at each institution died. If these findings are representative of other institutions across the United States, the incidence of stroke secondary to chiropractic manipulation may be higher than supposed.

To assess this problem further, a randomized prospective cohort study could

establish the relative risk of chiropractic manipulation of the cervical spine resulting in a cervical artery dissection. But such a study may be methodologically prohibitive. More feasible would be a case-control study similar to one carried out by Smith et al⁵ in which patients who had experienced cervical artery dissection were matched with subjects who had not incurred such injuries. Comparing the groups' odds of having received chiropractic manipulation demonstrated that spinal manipulative therapy is an independent risk factor for vertebral artery dissection and is highly suggestive of a causal association. Replicating this study in a different population would be valuable.

Based on our findings, all patients who visit chiropractors for cervical spine manipu-

lation should be informed of the potential risks and of the need to seek immediate medical assistance should symptoms suggestive of dissection or stroke occur during or after manipulation. Until the actual level of risk from chiropractic manipulation is known, patients with neck pain may be better served by equally effective passive physical therapy exercises.¹

JFP

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Tell patients considering cervical spine manipulation to seek medical help if symptoms suggestive of dissection or stroke occur during or after manipulation.

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NEW

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