

# Current Concepts

## SPINAL MANIPULATION AND CERVICAL ARTERIAL INCIDENTS 2005

**T**HERE IS A GROWING CONCERN AND awareness of an association between chiropractic manipulation and cerebrovascular accidents (CVAs).

Unfortunately, opinion rather than fact has tended to dominate discussions regarding CVAs and chiropractic, even though there has been no definitive evidence that chiropractic adjustments cause strokes.

The good news is this monograph notes that a causative relationship between chiropractic manipulation and stroke is unlikely. There is an associative relationship between the two because people may go to chiropractors for relief of stroke-related symptoms.

Doctors of Chiropractic must recognize that a patient with a vertebral dissection/CVA may not show signs or symptoms other than those commonly seen in a D.C.'s office—such as unilateral neck pain or headache. These cases, which display none of the classic signs of CVA, are a challenge for every practitioner. When the classic signs are

present, stroke must be identified so the clinician will be able to avoid neck manipulation on these patients. Emergency intervention during the first hours is invaluable anytime a patient shows symptoms of a potential stroke—whether it's before, during or after treatment.

At NCMIC, we understand this information is vital to today's D.C.s as well as the patients they treat. So, we commissioned John J. Triano, D.C., Ph.D. and Greg Kawchuk, BSc, D.C., MSc, Ph.D., to undertake the creation of a new monograph including the latest research. This executive summary and full monograph (available to policyholders on NCMIC.com) present some of the most relevant findings.

This information is being provided to each of the 18 chiropractic colleges insured by NCMIC.

In addition, as part of our ongoing commitment to giving NCMIC doctors the best defense possible should the need arise, we are providing this information to our network of chiropractic defense attorneys. We expect this latest research

***Current Concepts:  
Spinal Manipulation and  
Cervical Arterial Incidents 2005***  
provides you with an analysis  
of the latest research.

**The document builds upon  
NCMIC's 2001 CVA monograph,  
while updating it with advances  
in epidemiologic, diagnostic  
and biomechanical evidence.**

Sponsored by NCMIC, this monograph focuses on empirical data and practical information, making it a must-read for D.C.s



**NCMIC**  
**Chiropractic Solutions®**

will be an important tool for our defense attorneys to use in presenting the most contemporary findings from recent research and to help overcome common biases held by judges and juries.

### KEY FINDINGS— WHAT CAN WE LEARN?

- The best scientific evidence available has shown no direct causative relationship between chiropractic spinal manipulations (cSMT) appropriately administered and stroke events.
- Cervical artery disease is a rare condition with symptoms very similar to benign conditions that are often treated with cervical spine manipulation (cSMT), creating the appearance of an associative relationship.
- Chiropractors may see patients who either are experiencing a stroke or are very close to experiencing a stroke due to a compromise in the vertebral or carotid arteries. Often, the patient's only symptom will be a cervical musculoskeletal complaint—a common complaint of patients when they go to see a Doctor of Chiropractic.
- Unfortunately, the symptoms of a dissection in progress are very subtle to non-existent, other than the occurrence of head/neck pain that patients present with every day. Warning signs of a potential dissection/CVA include sudden onset of headache/neck/face pain that's different than the patient has experienced before. Doctors must then watch for clinical indications of a more serious problem.
- If a doctor suspects a more serious problem, then they should heighten their awareness and watch for the clinical indications of a vertebral artery dissection. Patients with the following additional clinical risk factors

**There is an associative relationship between chiropractic and stroke because people often see D.C.s for relief of stroke-related symptoms.**

(details listed in the full monograph) may have poor underlying integrity of arterial structure and may be susceptible to injury and stroke; thus, their history should be evaluated carefully before receiving treatment:

- ✓ Integument (temperature, easy bruising, prolonged bleeding/wound healing)
- ✓ Musculoskeletal (chronic joint and limb pain)
- ✓ Nervous system (dysarthria, dysphasia, visual changes, dizziness, confusion, giddiness and vertigo)
- ✓ Cardiovascular system (stroke, TIAs, mitral prolapse, aortic dilatation, hypertension)
- ✓ Pulmonary system (emphysema, recent upper respiratory infection)
- ✓ Gastrointestinal system (bowel rupture)
- ✓ Genitourinary system (frequent urinary tract infection, hematuria)
- ✓ Drugs/medication (smoking, oral contraceptive)
- ✓ Physical trauma (which may injure arterial structures)
- ✓ Previous hospitalizations
- ✓ Migraine
- ✓ Connective tissue disease (autosomal dominant polycystic kidney disease, Ehlers-Danlos Type IV, Marfan Syndrome, Fibromuscular Dystrophy)
- ✓ Recent infection particularly upper respiratory
- ✓ Age less than 45 years old
- Suspicion should be high if any other brain ischemic signs or symptoms exist or if prior history of vascular problems is present.
- When risk factors are present and a dissection is suspected, the practitioner needs to get the patient to a hospital as soon as possible and should undertake the following:
  - ✓ Do not manipulate the neck
  - ✓ Place the patient on a flat surface in a rescue and recovery position, that is, lying on the side

- ✓ Call 911 immediately, note the time in the charts and tell the EMT:
    - A suspected stroke patient is in the office
    - Age of patient
    - Time of onset
    - Any known past medical history
  - ✓ Do not give the patient anything to eat or drink; they may be dysphagic and eating or drinking could result in aspiration
  - ✓ Do not allow patients who improve spontaneously to go home. An acute neurological deterioration requires urgent evaluation the same day. A transient ischemic attack (TIA) patient is at high risk for early recurrent stroke.
- At minimum, if the symptoms don't warrant a call to 911, the doctor should not manipulate the neck and immediately consult with the E.D./neurological specialists. The doctor should tell the E.D./neurological specialists that a dissection or stroke in progress is suspected and request an immediate evaluation/MRA-MRI.
  - If the signs aren't strong enough to warrant the above options, other forms of treatment can be given such as soft tissue therapy and physiological therapeutics. If the pain is substantially diminished after one to two visits, it's indicated to be of musculoskeletal origin and additional procedures are safe to administer.
  - If neck/head pain does not diminish within the normal trial therapy period (in most cases of dissection, it would have worsened by this time), then other diagnostic evaluations or second opinion should be considered.

**While a dissection in progress is difficult to diagnose, an actual stroke is much more obvious. If at any time a doctor sees the following signs of stroke, DO NOT manipulate the neck and get the patient to the hospital.**

### SIGNS OF STROKE

#### Can the patient:

- ... smile?
- ... raise both arms?
- ... stand steady on both feet with their eyes closed?
- ... speak a simple sentence with several vowels that run together such as: "simple Simon says?"
- ... stick out their tongue?

*Also known as* **THE 5 D'S AND 3 N'S:**

- Diplopia** ----- Double vision or other vision problems
- Dizziness** ----- Vertigo, light-headedness
- Drop attacks** -- Sudden numbness/weakness of face/arm/leg
- Dysarthria** ----- Speech disorders
- Dysphagia** ----- Difficulty swallowing
- Ataxia of gait** -- Difficulty walking
- Nausea** ----- Vomiting or queasiness
- Numbness** ----- Loss of sensation on one side
- Nystagmus** ----- Involuntary rapid eye movements

### CRITICAL QUESTIONS ANSWERED BY THE RESEARCH

#### What does the evidence reveal about the effectiveness of cSMT?

The evidence shows that chiropractic treatment is favorable for most conditions. Research shows a trial of spinal manipulation is advisable for patients with neck pain, neck-related upper extremity pain and headaches—as long as specific contraindications are absent. Treated conditions may include cervical sprain/strain injury, myofascial syndromes, discogenic pain, cervicogenic headache, pseudoradicular and radicular syndromes of the upper extremities.

### Do the therapeutic benefits of chiropractic care outweigh potential risks?

The monograph points to findings from a surprising source—the American Academy of Family Physicians (AAFP). Using evidence-based criteria, the AAFP endorsed the use of spinal manipulation in patients without severe neurological deficit.

Perhaps even more unexpected, the AAFP found insufficient evidence on the benefits of analgesics, NSAIDs, antidepressants, or muscle relaxants for neck pain. The AAFP further noted the well-documented adverse effects for their use.

It's significant that the AAFP, an independent professional organization, failed to caveat its recommendations on manipulation but felt compelled to point out risks for standard medical practices.

### Do cervical manipulations cause vertebral artery injury?

In general, the evidence shows neurological complications of chiropractic therapy are very rare (see section that follows). But is there an apparent association between cSMT and vertebral artery dissection (VAD)? The evidence shows the connection is weak, if it exists at all, and a result of pre-existing susceptibility.

In a study by Haldeman et al., in which the majority of the stroke cases were believed to be caused by cSMT, the time to onset of neurological dysfunction was immediately following the procedure. In 11 percent of these cases, symptoms occurred between one day and more than one week.

As noted in research by Beaudry and Spence, many patients experience pain with VAD, which if associated with a whiplash injury, may cause the patients to seek manipulation. Therefore, the temporal association between cSMT and VAD is not easily defined and questionable in determining overall causation.

To further explore this issue, Sir Bradford

Hill outlined a scientific, systematic approach for judging whether an association is a causal relationship between cSMT and vertebral artery injuries, which are summarized here.

#### Consistency of findings

If a relationship is causal, it would appear consistently in different studies and in different populations. However, this is not the case with

VADs. While incidents were

related to cSMT, the exact nature of the application of cSMT is generally unreported. This uncertainty is reflected in the variety of risk estimates (1 in 400,000 to 1 in 5.8 million) provided by population-based studies to date.

#### Strength of association

The strength of an association is defined in terms of the relative risk estimates based in analyses of published studies. It's difficult to determine the strength of the association between cSMT and vertebral artery injury because it's not possible to determine from the data at hand how many people were manipulated or not manipulated.

#### Temporal sequence

Used alone, temporality requires significant judgment and bias. The cause of a disease must precede the development of a disease; however, this criterion is very difficult to apply to the question of whether cSMT causes VAD. When

the time to onset of VAD symptoms following manipulation has been reported, they vary from immediate to as long as one month following treatment, indicating little to no correlation

between VAD and cSMT.

#### Dose-response relationship

This criterion states that as the dose of the factor increases, the frequency and/or severity of the disease increases. If a dose-response relationship is present, there is strong evidence for a causal relationship. For cSMT, dose-response

**The AAFP endorsed the use of spinal manipulation in patients without severe neurological deficit.**

**The signs and symptoms of a stroke may be subtle and may mimic other conditions, so it can be hard to tell if a serious problem exists.**

relationships are not evident as the majority of patients who receive cSMT don't have strokes. Even those who do often have prior treatment do so without experiencing an adverse event.

### Specificity

Specificity is shown if the factor being studied can be isolated from other potential factors and then shown to produce changes in the incidence of the disease. A review of the literature demonstrates that there are additional instances of VAD without a history of cSMT. In the case-series study by Dziewas et al., VADs were also noted to occur in the absence of manipulation, following trivial trauma (e.g., yoga, scuba diving and roller coaster rides). Extreme neck movements occur many times throughout the day, and most people will not suffer from a VAD. Given these facts, the criterion for specificity is unsatisfied.

### Biological plausibility

Biologically plausible mechanism that explains the alleged relationship between cSMT appropriately applied and VAD is weak.

### Alternate explanations

In the case of cSMT and vertebral artery injury, there are alternate explanations for how these events could appear to be related, but are truly unrelated.

### Population studies

In the cervical arteries, the incidence of dissection has been estimated to be 2.6 per 100,000 in the general population, at or greater than the rate seen in patients receiving cSMT. Given that one-quarter of these injuries occur in the vertebral artery, dissection of the vertebral artery is considered to be uncommon, but not entirely rare. Under these conditions, withholding appropriate treatment cannot reduce the likelihood of stroke within the population.

### Cadaveric studies

Vascular flow rate changes in artificially perfused vessels have been examined during a

variety of neck positions. The vertebral arteries provide about 10 percent of the blood to the brain. Unless the vessel system is compromised, flow reduction due to neck motion is short-lived and well tolerated. Studies suggest that arterial strains observed during cSMT appear to be similar to those experienced during normal motions and far below the failure level for the tissue.

### What is the incidence and prevalence of stroke?

Cervical artery dissection (CAD) is a recognized cause of ischemic stroke among young and middle-aged individuals. While the connection between cSMT and CAD is weak at best, the research addresses whether a dissection is something a typical chiropractor could expect to see.

**The risk of serious arterial stroke syndromes is estimated to be less than 1 in 2 million, to 1 in 3.8-5.8 million cervical manipulations.**

For the general population, the data shows the rate of dissection to be 2.6 cases per 100,000 persons. The dissection of the vertebral artery is considered to be uncommon, occurring at most in 1.2/100,000 persons (45 percent of 2.6/100,000). Surveys of clinicians estimate of the incidence of serious cerebrovascular syndromes following cervical manipulation range from 1 in 400,000 to 1 in 5.8 million.

Using data from two of the largest chiropractic insurers, the risk of serious arterial stroke syndromes is shown to be less than 1 in 2 million to 1 in 3.8 to 5.8 million cervical manipulations. The most common type of vascular lesion with this association is a dissection of the vertebral artery.

A case control series from Ontario by Rothwell et al. suggested that, within large confidence levels, the incidence of vertebrobasilar accident within one week of chiropractic treatment is 1.3 cases for every 100,000 persons aged under 45 years receiving chiropractic treatment for a neck complaint.

**In summary, the incidence of CAD or cerebrovascular incidents following spinal manipulation to the neck is very small and at the same magnitude that occurs in the general population. The age distribution for stroke from arterial**

dissection without manipulation parallels the most common age range of patients seeking consultation for manipulation. Similarly, the gender distributions of stroke victims and the group of persons receiving manipulation therapy are almost identical.

Although there may be biological plausibility linking these two events, there are numerous alternate explanations for their relation. Little, if any, evidence of a strong association exists.

### WHAT CLINICAL AND BIOMECHANICAL ISSUES ARE INVOLVED IN A STROKE?

While the preceding information shows neurological complications of chiropractic therapy to be very rare, complications do occur.

The careful practitioner needs to know if the mechanical issues involved with cSMT could be related to a vertebral artery injury. Factors to consider include:

- **Cervical spine manipulation**

There are considerable case studies describing the onset of vertebral artery injury following a manipulation. Yet, as described earlier, association alone doesn't mean causation. The relevant question is: "Is it possible that the mechanical environment created by cSMT can injure the vertebral artery?" If so, there are four possible scenarios whereby vascular injury and cSMT may be related to each other (the four C's): catastrophic, congenital, cumulative or coincidental.

**1. Catastrophic.** In this scenario, cSMT would overload the vasculature of the neck, resulting in injury. Biomechanical and clinical evidence shows this to be unlikely. Given the frequency of manipulation without incident, it's doubtful a healthy artery would fail catastrophically because of cSMT.

**2. Cumulative.** It has been proposed that injuries could be caused by successive manipulations. If a person had no initial reaction to cSMT, then suddenly had an adverse reaction,

was it due to the cumulative effect of manipulations? Or, had the vessel become increasingly susceptible to injury through a process not related to cSMT? There is little evidence either way.

**3. Coincidental.** Is it possible that persons suffering from symptoms caused by a dissection seek help from chiropractors? Since the rate of incidence of dissections in the general population and among those receiving cSMT is essentially the same, it appears cSMT and the injury is unrelated. Case studies exist that confirm this possibility.

**4. Congenital/Developmental.** Some injuries to the vertebral artery are immediately followed by the onset of neurological symptoms. However, these cases of immediate injury may not represent catastrophic failure of the vessel under the loads of manipulation, but an aggravation of an existing abnormality.

**While the connection between CVAs and cSMT is minimal at best, there are ways D.C.s can assist in more prompt diagnosis and treatment.**

- **Cervical spine trauma**

The magnitude of trauma is not always related to the extent of tissue damage. And specific tissues can be singled out while others are left untouched. Factors such as the direction of force, force attenuation, force shielding and prior tissue status likely play important roles in determining which tissues are affected and which are spared by injurious forces.

- **Stenosis and thrombosis**

Neurological malfunction begins within seconds if flow of oxygen in these tissues is reduced below a critical level either from hemorrhage or ischemia.

- **External compression**

Most commonly, sources of external compression involve degenerative osseous structures.

- **Vasospasm**

Secondary vasospasm appears to be a nonspecific response to head injury that can be trig-

gered by escape of blood into the cerebrospinal fluid. The natural course of vasospasm associated with hemorrhage starts around day two, reaches maximum around day four and persists until the second week. Angiographic findings are absent by day 30. In contrast, spontaneous vasospasms without mechanical triggers are temporary, unrelated to hemorrhage and may go unnoticed. Resolution is equally spontaneous.

- **Anatomic variants and their role in vertebral artery injury**

A large number of reports indicate that variations in vertebral artery anatomy of the most critical type, including bilateral absence, can be tolerated neurologically. However, a number of cases have been noted where only differences in diameter appear to be the cause of discernable neurological symptoms.

- **Transient compression**

Flow reduction may be an entirely asymptomatic event in most individuals and may accompany normal activities of daily living. Arterial compromise may exist during neck motion in some persons, but it is of no consequence; the artery is compromised, but the system is not.

- **Hemostasis**

cSMT is an unlikely cause of hemostasis because the duration of the procedure is so short—typically less than one second. Hemostasis, should it occur in that short duration, would be uneventful.

The monograph shares research on complications following cervical procedures. Out of approximately 228,050 cervical procedures, 171 patients (about 8 in 10,000) had complications, both trivial and serious. The majority of complications occurred following low velocity procedures rather than from high velocity methods. While only 83 patients (less than 4 in 10,000) experienced adverse reactions, each one reported approximately two different events suggesting an inherent sensitivity to manual procedures.

In addition, the monograph devotes four chapters to anatomy and biomechanics as they relate to chiropractic. This information provides an excellent primer for new chiropractors and a practical refresher for seasoned D.C.s.

Doctors are encouraged to review the complete document on [www.NCMIC.com/cva](http://www.NCMIC.com/cva)—free for NCMIC policyholders. Printed copies of the entire monograph are available for \$29.95 for NCMIC policyholders/\$59.95 for all other D.C.s by contacting the Foundation for Chiropractic Education and Research, 1-800-622-6309.

## ACKNOWLEDGEMENTS

*Current Concepts: Spinal Manipulation and Cervical Arterial Incidents 2005* is a derivative work. It is with grateful appreciation to Allan Terrett the author of the original monograph, *Current Concepts in Vertebrobasilar Complications following Spinal Manipulation*, that this work was possible.

The full monograph was co-edited by John J. Triano, D.C., Ph.D., and Greg Kawchuk, BSc, D.C., MSc, Ph.D., with contributors including: M. Ram Gudavalli, PhD, Michael T. Haneline, D.C., M.P.H., Michael D. Hill, M.D., MSc, FRCPC, and Shari Wynd, BSc, BAsC, MAsC, D.C.

# Warning Signs of a Potential Dissection/CVA



the patient presents with sudden onset of headache/neck/face pain that's different than the patient has ever had before ...



heighten your awareness and watch for the clinical indications of a vertebral artery dissection, and ...

## Evaluate for a history of:

- **Integument** (temperature, easy bruising, prolonged bleeding/wound healing)
- **Musculoskeletal** (chronic joint and limb pain)
- **Nervous system** (dysarthria, dysphasia, visual changes, dizziness, confusion, giddiness and vertigo)
- **Cardiovascular system** (stroke, TIAs, mitral prolapse, aortic dilatation, hypertension)
- **Pulmonary system** (emphysema, recent upper respiratory infection)
- **Gastrointestinal system** (bowel rupture)
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- **Drugs/medication** (smoking, oral contraceptive)
- **Physical trauma** (which may injure arterial structures)
- **Previous hospitalizations**
- **Migraine**
- **Connective tissue disease** (autosomal dominant polycystic kidney disease, Ehlers-Danlos Type IV, Marfan Syndrome, Fibromuscular Dystrophy)
- **Recent infection** particularly upper respiratory
- **Age less than 45 years old**

## Differentiating “normal” head and neck pain from a CVA

- **Transient Ischemic Attacks (TIAs)** —often have similar symptoms to a CVA. If the patient suffers from carotid TIAs, get quick medical referral. The patient may suffer a complete stroke after only a few episodes.
- **Dizziness, unsteadiness, vertigo, giddiness**—Question patient about:
  - ▶ Aggravating factors, such as neck position or movement,
  - ▶ If any other 5 Ds And 3 Ns exist (*see right*)
  - ▶ Whether new symptoms have occurred or existing symptoms aggravated by previous cSMT
- **Migraine headaches.** When a patient presents with a migraine, stroke is uncommon and is usually in the posterior cerebral artery.
- **Cervicogenic headaches** primarily feature:
  - ▶ mechanical precipitation or aggravation of head pain
  - ▶ facet joint tenderness
  - ▶ neck muscle tenderness
  - ▶ palpatory pressures reproducing head symptoms.

**If you suspect a dissection or stroke ...**

**DO NOT manipulate the neck and get the patient to a hospital!**

- ✓ Place the patient in a rescue and recovery position
- ✓ CALL 911 immediately
- ✓ DO NOT give the patient anything to eat or drink
- ✓ DO NOT allow patients who improve spontaneously to go home

## SIGNS OF STROKE



- ... smile?
- ... raise both arms?
- ... stand steady on both feet with their eyes closed?
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- ... stick out their tongue?

## Also known as the 5 D's And 3 N's:

- Diplopia** ----- Double vision or other vision problems
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- Dysarthria** ----- Speech disorders
- Dysphagia** ----- Difficulty swallowing
- Ataxia of gait** -- Difficulty walking
- Nausea** ----- Vomiting or queasiness
- Numbness** ----- Loss of sensation on one side
- Nystagmus** ----- Involuntary rapid eye movements

Treatment for CVAs must be given within **3 HOURS** to be effective



**If you're not sure, at minimum ...**

**DO NOT manipulate the neck and call the ER**

- ✓ Tell them you suspect a dissection or stroke in progress and request an immediate evaluation/MRI-MRA.

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