

## Vertebrobasilar Artery Insufficiency (VBI) and Cervical Artery Dissection (CAD)

This protocol has been updated adopting many of the recommendations from 1) the 2005 Canadian Chiropractic Clinical Practice Guideline and 2) Current Concepts: Spinal Manipulation and Cervical Artery Incidents (a 2006 NCMIC Monograph).

**ATTENTION:** Interns must *immediately* notify a clinical supervisor of any significant adverse response to cervical manipulation or the pre-adjustment set up. Such responses would include dizziness, vertigo, nausea/vomiting, visual changes, anxiety, pre-syncope, syncope, new or increased extremity symptoms, or a significant increase in neck symptoms or headache.

Vertebrobasilar artery insufficiency (VBI) refers to insufficient blood flow through the vertebral and basilar arteries to the midbrain, cerebellum, or posterior cerebral regions. CAD refers to dissection of the cervical artery. Injury to the vertebral arteries can also result in stroke and/or syndromes associated with stroke.

The problem of vertebral artery injury presents itself to manual therapists in three ways:

- 1) Is a patient's chief complaint the result of VBI or CAD in progress?
- 2) Is a patient at greater risk for such an event?
- 3) Is a patient likely suffering this response after (but not necessarily due to) manipulation of the neck?

### SIGNS AND SYMPTOMS OF VBI/CAD

- New or sudden onset of head/upper neck/face pain unfamiliar to the patient.
- "5 D's And 3 N's": Diplopia, dizziness (vertigo, light-headedness, giddiness), drop attacks, dysarthria, dysphagia, ataxia of gait, nausea, numbness and nystagmus.

There are no definitive symptoms or physical exam findings that establish the diagnosis of a vertebral artery dissection until frank neurologic signs develop. Most symptoms are vague and overlap with more common and benign conditions.

The most important findings in the history that would warn of possible vertebral artery disease are the following:

1. **New or sudden onset of head/upper neck/face pain unfamiliar to the patient.**

Helpful clues include whether the onset was quite sudden (like a "thunderclap"), the pain is described as the worst neck pain/headache the patient has ever experienced, and whether it is unlike any previous episode the patient has ever had. Note that the presentation may not follow this classic outline. Also other conditions may present in a similar fashion, ranging from subarachnoid hemorrhage to something more benign like an idiopathic thunderclap headache.\*

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\* Thunderclap headache is an emergent referral. Causes include subarachnoid hemorrhage, unruptured intracranial aneurysm, and arterial dissection. When these are ruled out, an idiopathic thunderclap headache may be a diagnosis by exclusion.

## 2. Signs and symptoms of vertebrobasilar ischemia (“5 D’s And 3 N’s”):

- Diplopia (or other visual problems)
- Dizziness (vertigo, light-headedness, giddiness) (See CSPE protocol, [Dizziness/Vertigo: Immediate Care for Sudden Onset.](#))
- Drop attacks (sudden weakness in face/arm/leg)
- Dysarthria (speech disorder)
- Dysphagia
- Ataxia of gait (hemiparesis)
- Nausea (possibly with vomiting)
- Numbness (hemianesthesia)
- Nystagmus

Dizziness, unsteadiness, giddiness and vertigo are among the most important and challenging factors to consider. (Triano 2006) Although dizziness or vertigo can be the only sign of VBI, Savitz (2005) reports that a single isolated finding is rarely an indication (< 1%). Likewise, light-headedness in the absence of neurological signs or an isolated episode of vertigo lasting more than 3 weeks usually is not a sign of VBI. Some also question whether drop attacks are a sign of VBI because VBI more commonly causes persistent extremity weakness. (Savitz 2005) However, since drop attacks may be the sign of other serious conditions, they require further investigation.

### FACTORS ASSOCIATED WITH A HIGHER RISK FOR VBI AND CAD

A 2008 population-based case-control and case-crossover study found an association between VBA stroke and chiropractic visits in those under the age of 45, but there was a similar association with primary care medical visits across all age groups. This study could detect no excess risk of VBA stroke associated with chiropractic care. The authors concluded that the vascular events were likely already in progress and were the reason the patient sought medical or chiropractic care. (Cassidy 2008)

A number of other risk factors have been identified which may signal that a patient is more susceptible to a dissection, spontaneous or otherwise. Overall, there is

only a weak association with environmental risk factors. Most of the research to date is based on case control studies and is susceptible to information and selection bias. The validity of this evidence must be regarded with caution. (Rubinstein 2005) Further, it is unclear whether these same risks significantly increase the risk that has been attributed to cervical manipulation (i.e., estimates range between less than 1:1 million to 1: 5.8 million cervical manipulations) (Triano 2006).

Nonetheless, current recommendations are to take these risk factors into consideration when evaluating and treating patients. (Triano 2006) These risk factors for CAD include the following:

- Connective tissue disease including autosomal dominant polycystic kidney disease, Ehlers-Danlos type IV, Marfan syndrome, and fibromuscular dystrophy
- Migraine headaches
- Recent infection, particularly upper respiratory, when associated with any of the “5 D And 3 Ns” symptoms, especially in patients under 45 years of age.

Other risks factors have also been identified. Odds ratios specifically for CAD have been reported for many of these factors (see table).

### ODDS RATIOS/PROPORTIONS FOR CAD (Rubenstein 2005, Triano 2006)

**Note:** An odds ratio of 1.0 represents no additional risk.

Risk Factor	Odds Ratios/Proportions
Aortic diameter > 34 mm	OR=14.2; CI 3.2-63.6
Homocysteine > 12umol/L	OR 11.02; CI 2.25-44.23
Connective tissue disease	55-68% in CAD, 0% in control
Trivial trauma	OR=3.8; CI 1.3-11
Migraine	OR=3.6; CI 1.5-9.6
Infection within 4 weeks	OR=3.0; CI 1.1-8.2*
Infection within prior week	OR=2.4; CI 1.01-5.80*
Mechanical stress of cough, sneeze, vomiting	OR=1.60; CI 0.67-3.80
Age < 45	cases significantly younger than controls

\* Infections overall OR 1.60; 0.67 to 3.80 when adjusted for mechanical stress associated with coughing, sneezing and vomiting.

Although oral contraceptive use increases the risk for stroke (especially among smokers), this use does not appear to increase the risk for CAD (only 1 out of 3 studies found a statistically significant association) (Rubinstein 2005). Atherosclerosis, likewise, is a risk factor for stroke but not a risk factor for CAD. The Canadian CPG (2005) cites smoking as a risk factor for CAD.

## **HISTORY**

Patients who are candidates for cervical manipulation should be screened for the previously listed risk factors.

In the case of patients who present with any of the “5 D’s And 3 N’s,” further questioning should focus on whether a stroke, dissection, or VBI episode is in progress.

### **Clues from the history (including past health and systems review)**

- Fever (e.g., signaling current infection)
- Skin: easy bruising, prolonged bleeding/wound healing, loose thin translucent skin (associated with Ehlers-Danlos type IV syndrome)
- Musculoskeletal: chronic joint and limb pain
- Nervous system: dysarthria, dysphasia, visual changes, dizziness (vertigo, giddiness), confusion, new headache/face pain
- Cardiovascular system: history of stroke or transient ischemic attacks (TIAs), mitral prolapse, aortic dilatation, hypertension
- Pulmonary system: history of emphysema (can be associated with A1-antitrypsin deficiency), recent upper respiratory infection
- Gastrointestinal system: history of bowel rupture (can be associated with Ehlers-Danlos type IV syndrome)
- Genitourinary system: frequent urinary tract infection, hematuria
- Drugs/medication including smoking and oral contraceptives
- Recent physical trauma (trivial head and/or neck trauma has been associated with injury to vertebral arteries)

- Previous hospitalizations (e.g., screen for reasons associated with stroke or connective tissue diseases)

The patient should also be asked whether s/he has had adverse reactions to cervical manipulation in the past. Although an answer in the affirmative should alert the practitioner to use greater caution in the selection of treatment and monitoring treatment response, it should be noted that the absence of a prior history of post-manipulative adverse effects does not decrease the incidence of having a future vertebrobasilar event.

## **PHYSICAL EXAMINATION**

If a patient's symptoms (or the presence of risk factors) suggest a possible VBI, but the history is inconclusive, then a thorough physical exam is warranted. (Haneline 2004) The Canadian Chiropractic Practice Guideline (CPG 2005) suggests that when patients present with vertigo, for example, the physical should screen for the presence of neurovascular impairment, especially unilateral facial paresthesia, objective cerebellar signs, visual field defects, or lateral medullary signs.\*

Triano (2005) recommends that the following exam procedures be performed when the history suggests the possibility of VBI.

- Observation** should include skin appearance (e.g., bruising can be associated with Ehlers-Danlos type IV syndrome), presence of extremity disproportion or anomalous thorax structure (e.g., Marfan's syndrome).
- Blood pressure (HTN).** Hypertension has not been linked with dissections that have occurred after manipulation. However, in studies of spontaneous vertebral artery dissection, hypertension has been noted in 48 to 53 percent of cases. (Triano 2005)
- Pulse.** Asymmetry in peripheral pulses can suggest vascular disorders (e.g., arterial

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\* AKA Wallenberg's syndrome: symptoms include vertigo, dysarthria, ataxia, facial pain/numbness, ipsilateral loss of pain and temperature, diplopia and dysphagia.

steal syndrome, aortic aneurysm, arterial thrombosis), or signs of infection (rapid pulse).

- Auscultation** may reveal mitral valve disorders common to Marfan's patients or the presence of a dysrhythmia.
- Abdominal palpation** can identify significant enlargement of internal organs (e.g., polycystic kidneys are palpable in an adult).
- Assessment of higher brain centers, cranial nerves, and peripheral nerve function.** A *brief mental status exam* and cerebellar assessment can be done. Upper and lower extremities can be tested for sensory loss, motor weakness, abnormal DTRs, and the presence of pathological reflexes.
- Peripheral joint hyper flexibility and skin elasticity.** (connective tissue disease)

## **CAROTID ARTERY DISSECTION (CAD)**

The Canadian Chiropractic Clinical Practice Guideline (CPG 2005) states that “the evidence suggests that manipulation is not associated with CAD.” CAD, however, may be the condition driving the patient to seek care.

The most common presenting symptoms are sudden severe headache, facial pain or anterior neck pain (>90% of patients). Symptoms include those consistent with a TIA or stroke (50-90% of patients), including transient monocular blindness (6-30%), miosis & ptosis (partial Horner's syndrome) (<52%), visual scintillations (33%), and impairment of taste (10-19%). Other symptoms reported include confusion, hemianesthesia, hemiparesis or monoparesis.

### **MANAGEMENT**

A clinical presentation suggesting VBI or CAD constitutes an emergency referral. (See CSPE protocol: [Stroke](#), [Acute/TIA](#): Immediate Evaluation and Care.)

**NOTE:** *The following are suggested to be absolute contraindications against cervical manipulation and should be referred immediately: severe, persistent HA unlike anything the patient has previously experienced, unilateral facial paresthesia, objective cerebellar signs, lateral medullary signs, visual field defects. (CPG 2005)*

Onset of new headache or new cervical pain affecting the upper quadrant of the neck associated with true vertigo is of significant concern. The practitioner should consider diagnostic imaging (e.g., Doppler, MRI, MRA) before applying cervical manipulation. (Triano 2006)

After the physical examination is complete, if the clinical presentation still remains unclear and VBI is still a reasonable possibility, referral for further diagnostic testing and/or neurological consult should be done before pursuing cervical manipulative therapy.

The Canadian CPG recommends caution when treating patients with known arterial tissue abnormalities, trauma, or a history of smoking, but does not view these factors as contraindications to manipulation. Likewise the presence of the “5 D's And 3 N's” do not themselves constitute an automatic absolute contraindication to manipulation (CPG 2005).

“If signs aren't strong enough to warrant referral, 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 indicative to be of musculoskeletal origin and additional procedures are safe to administer.” (Triano 2006)

Otherwise, proceed with screening the patient for manipulation.

### **Pre-Cervical Manipulation Screen**

Prior to any treatment, it is critical that an appropriate PARQ be done. If the patient seems to have risk factors or symptoms suggestive of VBI, this information must be shared with the patient, over and above the information provided in the printed Informed Consent form used in the clinics.

As pre-manipulation screening tests, auscultation of the carotid or subclavian arteries and/or VBI head positioning tests should NOT be done because they are known to have no diagnostic value in identifying those at risk of cervical vascular injury. In the context of VBI screening, these procedures should be “abandoned for clinical and medico-legal purposes.” (Terret 2001)

### **Pre-Adjustive Setup**

The practitioner may choose the following approach (Terrett 2001):

- Hold the patient’s head and neck in the pre-adjustive position.
- Note whether the patient has a “hard” or “soft” positive response.

### **A “hard positive” response**

Patients who display “hard positive” responses to the set up (or to a subsequent adjustment) such as pre-syncope, syncope, vertigo or nausea should be further evaluated. (See CSPE protocol, [Dizziness/Vertigo: Immediate Care for Sudden Onset](#).)

- The patient should be observed in the office for at least 20-30 minutes to monitor changes in symptoms. If after this time the new symptom(s) has resolved, and the clinician is comfortable that the episode did not represent a TIA or other significant event (see management for TIA), the patient may be released. If the symptom(s) persists, then the patient requires further evaluation.
- A “Therapeutic Alert” will be permanently placed in the patient’s chart.
- Cervical manipulation with thrust adjustments, as well as any treatment requiring the head to be held in extreme rotation or extension, is prohibited pending the results of a further evaluation.

### **A “soft positive” response**

Patients who display a “soft positive” response such as dizziness may well be suffering from joint dysfunction. In these cases, the dizziness should be appropriately evaluated.

If manual therapy is performed, it should be done by the clinical supervisor or, when appropriate, by an intern with excellent skills under close supervision. The treatment may consist of soft tissue therapy, low force adjustments, or carefully modulated thrust techniques, based on the experience and opinion of the treating clinician.

Cervical manipulation as practiced in our clinics emphasizes achieving segmental pre-adjustive tension by combining vectors in the positioning of the patient. For example, in a rotational adjustment at C2, pre-adjustive tension is most efficiently achieved by combining segmental lateral bending at C2 along with the desired rotation. This approach creates segmental pre-adjustive tension short of the end-range of C2 rotation because of the cumulative effect of the superimposed contralateral lateral bending. Advantages include less adjustive force being required with presumably less tensile force applied to the vertebral artery. The Canadian CPG (2005) also suggests minimizing rotation.

A “Therapeutic Alert” will be temporarily placed in the chart. The response to treatment will be carefully monitored and charted, and the patient will be re-evaluated in a pre-adjustment position each visit in which manual therapy is contemplated.

When the patient converts to a negative test response and the clinician is convinced that the soft positive was due to a local mechanical problem, the “Therapeutic Alert” can be modified, dated, and moved to the appropriate section of the chart.

## **ADVERSE POST-MANIPULATION RESPONSE**

A rapid assessment for stroke includes the following steps.

### **Can the patient:**

- ✓ Smile?
- ✓ Raise both arms?
- ✓ Stand steady on both feet with his/her eyes closed?
- ✓ Speak a simple sentence with a series of different vowel sounds that run together such as: "simple Simon says?"
- ✓ Stick out his/her tongue?

### **Action Plan**

**Step 1.** Do not manipulate their neck again.

**Step 2.** Do not give the patient anything to eat or drink (to prevent possible aspiration).

**Step 3.** The patient should be triaged into one of three suspected categories

**A) Stroke, VBI, CAD, TIA.** There is a reasonable likelihood of stroke or other significant event. A key feature of a stroke is that it has a very sudden onset, over 1-2 minutes as opposed to hours. Call 911 immediately (*continue to step 4 in the Action Plan*).

**B) Resolving TIA.** There is a reasonable likelihood that the patient experienced a TIA or other concerning event. The patient requires same day evaluation and should not

drive. Patients who have a TIA (especially if they have had motor weakness or speech disturbance) are at risk for stroke. 10-20% of these patients will have a stroke within 90 days, the majority of which will occur within 48 hours. If they have a primary care physician (PCP), s/he can be called to see whether the patient can be evaluated on the same day. The patient can be referred to urgent care or an emergency room. Transportation can be arranged with a friend, family member, or other appropriate transport.

**C) Benign Response.** The patient appears stable and the likelihood that a stroke or TIA occurred is remote. The patient must be monitored for 20-30 minutes post treatment and, if stable, can drive.

**Step 4.** If not already done so, call 911 immediately. Tell the 911 operator:

- You have a suspected dissection or stroke patient in the office, *which occurred post manipulation*,
- age of patient,
- exact time of onset, and
- any pertinent past medical history.

Take blood pressure as a baseline. Apply CPR or oxygen if necessary.

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