Cervical Spine Adjusting
and the Vertebral Artery

Contemporary perspectives on patient safety and protection, clinical reality and patient management

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Why?

Currently the single most important issue related to the practice of chiropractic from a public safety issue standpoint is associated with vertebral artery related matters.

Similarly, a key issue from a public relations perspective is related to the practice of chiropractic as associated with vertebral artery related matters.
Why?

The Lewis Inquest in Toronto, Ontario has provided a treasure trove of information related to vertebral artery issues of interest to practicing chiropractors.

The recent controversy surrounding Vioxx and Accutane signals a changing public expectation with respect to health care interventions.
Outcomes of the presentation

- a. To provide the practicing chiropractor with a review of the relevant anatomy, physiology and pathology associated with vertebral artery injuries and in particular vertebral artery dissection to assure an understanding of the basic mechanisms involved.

- b. To offer the practicing chiropractor a review of the current demographic and incidence data, the sources of the data and the strengths and weaknesses of the data associated with vertebral artery injury and cervical spine adjusting.
Outcomes of the presentation

- c. To provide the practicing chiropractor with current thoughts on the appropriate procedures to be used before the initiation of cervical spine adjusting and the recommended procedures in the event a patient demonstrates signs of VBAI before, during or after a care encounter.

- d. To provide the practicing chiropractor with the current perspectives on VAD in progress and the clinical warning signs of the patient who presents in a potentially compromised state as well as the most appropriate response thereto.
Let’s Take It from the Top!

1. Gross anatomy review
2. Histology of blood vessels review
3. Review of basic pathology mechanisms:
   a. Injury and inflammation
   b. Clotting and thrombus formation
   c. Emboli
   d. Ischemia
Gross Anatomy Review

1. Arterial circulation:
   a. Origin of Vertebral arteries
   b. Course of the Vertebral arteries
   c. Distal distribution from the Vertebral arteries
   d. Common anomalies of the Vertebral artery(ies)
1. Arterial Circulation

a. Origin of the Vertebral arteries:

i. The left and the right Vertebral arteries arise from the Subclavian artery.

ii. They arise proximal to the Thyrocervical trunk and distal to the Common Carotid artery.
1. Arterial Circulation

b. Course of the Vertebral arteries:

i. The Vertebral arteries are divided into four segments as they ascend the cervical spine

1. From the Subclavian artery to the transverse foramen of C5/C6
b. Course of the Vertebral arteries:

i. The Vertebral arteries are divided into four segments as they ascend the cervical spine

II. Within the transverse foramina from C5/C6-C2
b. Course of the Vertebral arteries:

i. The Vertebral arteries are divided into four segments as they ascend the cervical spine

iii. From the superior of C2 foramen to the dura
b. Course of the Vertebral arteries:

i. The Vertebral arteries are divided into four segments as they ascend the cervical spine

iv. From the dura forward
1. Arterial Circulation

c. Distal distribution from the Vertebral arteries

i. From the Subclavian artery the Vertebral arteries continue to unite and form the Basilar artery

ii. Prior to the junction of the right and left Vertebral arteries forming the Basilar artery the Posterior Inferior Cerebellar artery (PICA) is given off.
1. Arterial Circulation

d. Common anomalies of the Vertebral artery(ies)

i. Approximately ten percent of patients have some form of anomaly in their Vertebral artery(ies).

ii. Compression of the Vertebral artery(ies) is seen in 5% of the population in a neutral position and the same in rotation.
1. Arterial Circulation

d. Common anomalies of the Vertebral artery(ies)

iii. Unilateral or bilateral absence of the Vertebral Artery

iii. Variations in arterial diameter, average 4.3 mm on the right, 4.7mm on the left

v. Segment I, tortuous vessel in 39% of specimens
1. Arterial Circulation

d. Common anomalies of the Vertebral artery(ies)

vi. The origin of the Vertebral Artery varies in 3.5% of cases

vii. In 5%-20% of specimens the Posterior Inferior Cerebellar Arteries have an extra dural origin approximately 1 cm. proximal to dural penetration.
1. Arterial Circulation

d. Common anomalies of the Vertebral artery(ies)

viii. 7% of Vertebral arteries cannot be imaged due to the depth of the tissue

ix. Contralateral rotation can cause alterations in blood flow at the C1-C2 level on MRA

x. A change in excess of 56% is needed to detect alterations using Doppler imaging
2. Histology of blood vessels review

a. The Vertebral arteries are comparable in size and design to the Renal arteries or some of the smaller Coronary arteries.
b. They exhibit the typical 3 layer pattern from inside out of a tunica intima, tunica media and a tunica adventitia.
3. Review of basic pathology mechanisms:

a. Injury and inflammation

i. Arteriopathy may arise from heritable conditions such as Marfan’s Disease, Ehler Danlos Syndrome-type IV and VI, autosomal dominant polycystic kidney disease, or osteogenesis imperfecta type I (yielding cystic medial degeneration)

ii. Arteriopathy may also arise from fibromuscular hyperplasia
3. Review of basic pathology mechanisms:

b. Clotting and thrombus formation

i. Arterial damage, particularly involving the tunica intima will yield the start of increased localized clotting and thereby thrombus formation.

ii. Arterial flow changes can result from histological changes as well as from mechanical changes in the vessel.
Intimal dissection with blood flow beneath the intima and associated thrombus formation
3. Review of basic pathology mechanisms:

c. Emboli

i. Emboli present in three primary forms—liquid, solid or gaseous. The thrombus at the site of arterial damage is invariably the source of emboli yielding ischemic stroke from the Vertebral artery.
3. Review of basic pathology mechanisms:

d. Ischemia

i. The degree of ischemia resultant from an embolism is the consequence of the size of the embolism, the location of the embolism and the presence/absence of collateral circulation to the affected area.
From the Basics to the Advanced

1. Mechanisms (origins) of Vertebral artery dissection
2. Types of Vertebral artery dissections
3. Pathophysiology of various dissections to the Vertebral artery
4. Sequellae of dissections the Vertebral artery
1. Mechanisms (origins) of Vertebral Artery Dissection

a. The literature indicates that VAD arises spontaneously, from trivial movement, minor trauma or major trauma.

b. The following have been cited in the literature as preceding a VAD- Judo, yoga, ceiling painting, nose blowing, hypertension, oral contraceptive use, sexual activity, receiving anesthesia, use of resuscitation activities, receiving a shampoo, vomiting, sneezing, chiropractic care.
2. Types of Vertebral Artery Dissections

a. Dissections arise from an intimal tear. Yielding an intramural hematoma and they have been identified as subintimal or subadventital.

i. Subintimal dissections tend to result in stenosis of the artery

ii. Subadventital dissections tend to result in aneurysm formation.
3. Pathophysiology of Dissections of the Vertebral Artery

a. An expanding hematoma in the wall of the Vertebral Artery is the root of the problem. The intramural hematoma can arise from hemorrhage of the vasa vasorum within/associated with the tunica media or from the development of an intimal flap in the lumen of the vessel.
3. Pathophysiology of Dissections of the Vertebral artery

b. The consequences of the evolution of the hematoma include the following:

i. It seals off, remains small and is largely asymptomatic

ii. An expanding hematoma of a subintimal nature occludes the vessel yielding ischemia and a subsequent infarction

iii. A lesion of a subadventitial nature yields an aneurysm that is prone to rupture through the adventitia yielding a subdural hematoma
Subintimal v. Subadventitial

- Advantitia
- Media (Smooth Muscle)
- Intima

Blood Flow

BLOOD POOLING / SWIRLING

Vessel lumen

Aneurysm
b. The consequences of the evolution of the hematoma include the following:

iv. The intimal disruption results in an alteration of normal hemodynamics, the creation of a thrombogenic environment, the formation of a thrombus and the potential generation of emboli.
4. Sequellae of various forms of injury to the Vertebral artery

a. The effects of altered arterial flow through the Vertebral artery as a result of a dissection can yield few or minimal symptoms, transient ischemic attacks due to the altered circulation, development of thrombi and emboli potentially yielding ischemia and/or infarction.
Vertebral Artery Dissection

1. Mechanisms of origin
2. Incidence of VAD
3. Morbidity and mortality associated with VAD
4. Predisposing factors
5. Theorized predisposing factors
6. Predictors of VAD
Vertebral Artery Dissection

1. Mechanism of origin

   I. 43% of are spontaneous in nature
   II. 31% were associated with cervical spine manipulation
   III. 16% from trivial trauma
   IV. 10% from major trauma
Vertebral Artery Dissection

1. Mechanism of origin

ii. According to Beaudry and Spence (The Canadian Journal of Neurological Sciences, V. 30, No. 4, November 2003, pp. 320-304)

   i. The most common cause of traumatic Vertebrobasilar ischemia is motor vehicle accidents.

   ii. Of 80 cases that presented over 20 years to a single neurovascular practice, 70 were related to MVAs, 5 to industrial injuries, 5 associated with chiropractic. Consideration was offered that some of the cases that were related to chiropractors were also involved in MVAs further confounding the matter.
Vertebral Artery Dissection

2. Incidence of VAD (Schievink, NEJM 3/22/01)

a. For every 100,000 strokes of any origin there will be one stroke associated with a Vertebral artery dissection

b. Dissections account for 10%-25% of all ischemic strokes in young or middle aged persons

c. Less than 5% result in death and about 75% have a good recovery
Vertebral Artery Dissection

2. Incidence of VAD

d. VAD and CAD account for 2.6 per 100,000

e. Cervical dissections are the underlying etiology in 20% of ischemic strokes in patient 30-45 years of age.

f. Female to male ratio: 3:1 (disputed)

g. Average age: VAD-40, CAD-47 (disputed)
Vertebral Artery Dissection

2. Incidence of VAD

h. From the literature:

i. 1 in 5,000 adjustments cause a stroke (Norris, SPONTADS, unpublished)

ii. 1 in 20,000 adjustments cause a stroke (Vickers, BMJ, 1999)

iii. 1.3 in 100,000 patients (Rothwell, Stroke, 2001)
Vertebral Artery Dissection

2. Incidence of VAD

h. From the literature:

iv. 1 in 1 million adjustments (Hosek et al, JAMA, 1981)
v. 1 in 2 million adjustments (Klougart et al, JMPT, 1996)
vi. 1 in 5.85 million cervical spine adjustments (Carey et al, CMAJ, 2001)
2. Incidence of VAD

i. Discussion of range of incidence data from the literature:

i. The Rothwell data involves all patients who experienced a stroke within 7 days of a chiropractic office visit

ii. The Carey data reflects claims filed for a stroke following chiropractic care

iii. It is likely that among the Rothwell data there were unrelated strokes and among the Carey data there were unreported claims—therefore 1-2/per million
Vertebral Artery Dissection

3. Morbidity and mortality associated with VAD

a. “The reported death rate from dissections of the carotid and vertebral arteries is less than 5 percent.” Schievink, NEJM, 2001

b. “VAD has been associated with a 10% mortality rate in the acute phase.” E. Lang, M.D. Department of Family Medicine, McGill University;
Vertebral Artery Dissection

4. Predisposing factors

a. Please see the heritable conditions noted previously.

b. “approximately 5 percent of patients with spontaneous dissection of the carotid or vertebral artery have at least one family member who has had a spontaneous dissection of the aorta or its main branches.” (Schievink, NEJM 2001)
Vertebral Artery Dissection

5. Theorized predisposing factors:
   a. One case-control study in 1989 suggested migraine was a risk factor for cervical artery dissection (D’Anglejan, Headache, 1989)
   b. Hyperhomocysteinemia as reported by Pezzini, J Neurology, 2002
   c. Previous respiratory infection together with other neurological symptoms
Vertebral Artery Dissection

6. Predictors of VAD

a. “Thus, given the current state of the literature, it is impossible to advise patients or physicians about how to avoid vertebrobasilar artery dissection when considering cervical manipulation or about specific sports or exercises that result in neck movement or trauma.” (Haldeman et al, Spine 1999)
Clinical Pearl Number One

Current thinking holds that the majority of patients who develop frank symptoms of a vertebral artery dissection following chiropractic care were in the process of dissection when they presented for care.
In Support of this Idea

Did the SMT Practitioner Cause the Arterial Injury?

Manipulation of the Neck and Stroke: time for more rigorous evidence

Spinal manipulative therapy is an independent risk factor for vertebral artery dissection
Smith, Neurology, Vol. 60, pp. 1424-1428
The Other Side of the Question

Spinal Manipulative Therapy is an Independent Risk Factor for Vertebral Artery Dissection

Pre-adjustment screening tests

We were all taught “George’s Test”, “DeKlynes Test” and other tests for Vertebral artery competency.

You have been told by many people from your teachers, to your colleagues, to your professional liability carrier, to your risk management consultants to use these provocative tests—Don’t.
Pre-adjustment screening tests

George’s Test or DeKlyne’s Test yield an unacceptable percentage of false positives and of false negatives. It tells you nothing reliable.

For the patient who is a VAD-in-progress the testing may be enough to make a bad situation worse.
Pre-adjustment screening tests

In March 2004 all of the clinic directors of all of the U.S. chiropractic colleges and programs agreed to abandon the teaching of and use of provocative testing of this nature.

At the same meeting the presidents/deans accepted the recommendation of the clinic directors.
Pre-adjustment screening tests

Bottomline: There are no reliable or safe tests that will rule out a VAD-in-progress. There are no tests that will identify a patient at risk for VAD.

Your best evaluative tools are: Your ears and your gut.
What is a Person to Do?

If there are no clear-cut predisposing factors suggesting VAD, and
If there are no testing procedures helpful in ruling out potential VAD patients, and
If the great majority of VAD-in-progress patients present with musculoskeletal complaints, then,
What is a person to do?
What is a Person to Do?

Look, listen, ask and think
Look for What?

- **Five “Ds”**
  - Dizziness
  - Drop attacks
  - Diplopia
  - Dysarthria
  - Dysphagia

- **And**
  - Ataxia

- **Three “Ns”**
  - Nausea
  - Numbness
  - Nystagmus
Perspective on the 5 D’s, 3 N’s and the A!

Many patients present to chiropractors exhibiting one or more of these symptoms, many patients seek care for these symptoms, the presence of these symptoms, in and of themselves—may or may not be an indication of a possible VAD-in-progress, rather it is the constellation of symptoms (dizziness, nausea and diplopia for example), the uniqueness of the symptom (drop attacks for example) and the degree/severity of the symptoms that should draw the clinician’s attention.
Listen for What?

- Slurred speech
- Giddiness
- A change in voice pattern
- Lack of context in speech
- Inappropriate reactions to situations

One characteristic, almost pathognomonic phrase from your patient—whether they be an old or a new patient, getting their first adjustment or their 100th…
Clinical Pearl Number Two

The phrase:

“I have a pain in my neck and (or) head unlike anything I have ever had before.”
Clinical Pearl Number Three

For those patients who experienced a VAD, on follow-up 50% had a recent appearance of a new chief complaint of upper quadrant neck pain (occipital area) and/or the hemicranium. The pain was described as throbbing, steady or sharp, the “thunderclap” headache.
Pain referral common to Vertebral

Pain referral common to Internal Carotid
DC: Tell me some more about this pain.

DC: Were you doing anything before you experienced the pain, or did it come out of the blue?

Think About What?

Stopping cold in your tracks when you have heard *The* phrase.

Taking a step back, slowing down and paying close attention to everything about this patient.

Moving cautiously, discretion is the better part of valor.
In the presence of a patient who expresses non-traumatic or post-whiplash neck pain as a new chief complaint, who refers to the pain as unlike anything they have ever had before, who is exhibiting other neurological symptoms referral for evaluation of possible VAD before adjusting is strongly recommended.
When a Patient Shows Signs of Possible VAD following an Adjustment

Your management of the situation and your documentation of the situation are the most important issues in reducing morbidity and mortality as well as in limiting or reducing liability.
When a Patient Shows Signs of Possible VAD following an Adjustment

Your recognition of the post-adjustment symptomatic picture is critical. You cannot assume because a VAD is extremely rare it won’t or didn’t happen.

Keep your antenna up!
When a Patient Shows Signs of Possible VAD following an Adjustment

If the patient shows any of the 5 D’s, an A or any of the 3 N’s pay attention immediately.

If the symptoms are mild monitor them for their decrease or their resolution, if severe consider emergency services immediately.
What symptoms should be monitored?

Each situation will require a different response, but in general the clinician should be monitoring the patient’s vital signs as well as the specific neurological response that has drawn attention.

The availability of baseline vitals will cause this data to be more meaningful.
When a Patient Shows Signs of Possible VAD following an Adjustment

If the symptoms are very transient, limited and resolve quickly take a position of “watchful waiting”.

Consider the area adjusted, the type of adjustment given and if an alternate approach would be in order.

Do not readjust the patient at that time.
When a Patient Shows Signs of Possible VAD following and Adjustment

If the symptoms do NOT resolve monitor the patient, stay with the patient—no matter how stacked up the waiting room is.

Watch for the development of additional symptoms, note the mental status, degree of confusion if any, etc.

Do not readjust the patient at that time.
When a Patient Shows Signs of Possible VAD following an Adjustment

If the symptoms persist, or if the symptoms worsen seek emergency services support. Monitor the patient while waiting for support services.

Do not readjust the patient at that time.
Why Not Readjust?

IF the patient is experiencing a VAD there is no form of adjustment that will minimize the consequences of the dissection and the introduction of another force may serve to create emboli and increase the likelihood of an ischemic event.
Why Can’t I Wait and See What Happens?

If the patient has experienced a VAD, and if the VAD has resulted in a thrombus being formed and emboli being thrown it will result in cerebellar or brainstem ischemia. Emergency pharmaceutical intervention, i.e. tPA, is most effective in the first 90 minutes, moderately effective for three hours and possible effective for up to six hours—time is of the essence.
Professional Liability Complications

1. Your failure to recognize what is going on, to write it off as a “normal” or “typical reaction to an adjustment”.

2. Your failure to monitor and document the progress of the patient following the onset of the problem, as well as to document your thought processes regarding the situation.

3. Your failure to manage the situation properly and in a timely manner.
Professional Liability Complications

4. Readjusting the patient
5. Sending the patient home if in an unstable or fragile state
6. Taking a casual approach to seeing another provider- “you might want to…”
7. Failing to document what went on, what you were thinking, what you did, being less than honest and explicit in the record.
Tomorrow Morning

1. There is no need to be fearful of delivering a competent cervical spine adjustment
2. Pay close attention to the responses of patients following cervical spine adjustments
3. Do NOT assume it couldn’t happen in my office
Tomorrow Morning

4. Have a plan for what you would do if..., keep emergency numbers handy, discuss the possible scenario with your staff, plan and respond to the plan don’t react to a problem

5. Document, document, document

6. Understand the mechanisms involved and respond accordingly
Tomorrow Morning

7. Evaluate your procedures in general, are you asking the questions you should be asking, are you and your staff attuned to catching subtle changes in your patients, does your staff have mechanisms to let you know about things they see in patients?

8. Act in the best interests of the patient, always in all ways-this is ultimately in your best interest as well