The Chiropractic Report

www.chiropracticreport.com Editor: David Chapman-Smith LL.B. (Hons.) January 2014 Vol. 28 No. 1

Professional Notes

The Biopsychosocial Model Reviewed

SPINE has just published a review of 25 years living with the biopsychosocial model. This is by some of the world's most prominent researchers into primary care for low-back pain – chiropractic authors are Drs Gert Bronfort and Jan Hartvigsen.

Pincus, Kent, Bronfort et al. ask how far we have come since Gordon Waddell's seminal article in 1987 "marked a fundamental change in the conceptualization of back pain."

This model suggests, they say, "that back pain should be more broadly understood than is possible from a biomedical perspective alone, because for many individuals the main problem lies not with the common and frequently transient experience of pain, but rather in their own and society's perceptions and reactions to pain. Inappropriate reactions may include unnecessary avoidance of physical activity and social interactions, absenteeism from work, and high health care utilization."

continued on page 4

Cervical Spine Manipulation

New Evidence of Safety and Effectiveness

A. Introduction

SKILLED CERVICAL SPINE JOINT manipulation and mobilization are now established as safe, effective and appropriate treatments for patients with the most common forms of neck pain and cervicogenic headache, alone or in combination with exercises and soft-tissue therapies.

This is an accurate and easily defensible statement in terms of science and evidence-based clinical practice. It is also an important one for all patients to hear, whoever they may consult for treatments.

However it is too bland for the media which prefer controversy and the drama of an allegedly injured patient. This is especially so when the patient is supported by his or her physician or neurologist, who conveniently overlooks the basic scientific truth that one or a few anecdotal cases prove nothing at all about causation.

To illustrate this, some readers may recall a much-publicized study by neurologists Norris, Beletsky et al.[1] published in the Canadian Medical Association Journal in 2000 and suggesting that neck manipulation caused stroke, a suggestion that lead author Dr John Norris took to the media and then to a patient inquest.

Asked for comment at the same inquest when called to give expert evidence on causation, Dr David Sackett, known internationally as a father of evidence-based medicine and at that time the founding chair of the Clinic in Epidemiology at Oxford University:

• Explained that the study was a weakly-designed, retrospective case series that was of no scientific value whatsoever on the subject of any relationship between manipulation and stroke.

• Stated that Dr Norris had been "scientifically irresponsible" in making any claims on causation in the media based on this study, and had demonstrated that he was "incompetent as a scientist in the study of causation."[2]

Recalled to give further evidence on oath Dr Norris acknowledged that his study had not in fact produced a single case documenting stroke caused by manipulation, and his resignation from the position of Professor of Neurology at the University of Toronto School of Medicine followed quickly.

2. Reasons for returning to all of this are:

• A fresh outbreak in recent months of allegations that neck manipulation is unsafe. This includes media stories in Australia/New Zealand in October and in the USA this month. It also includes an attempt by critics to achieve a legal ban on upper cervical manipulation in the Netherlands, unsuccessful and denied by the Ministry in October after the Netherlands Chiropractors' Association had met with officials and presented the relevant scientific and clinical evidence. It seems that this is an area in which all doctors of chiropractic must constantly remain aware of likely challenge and how to meet it.

• More significantly, two important new research papers published in the January issue of the Journal of Manipulative and Physiological Therapeutics (JMPT). These, both winners of NCMIC Louis Sportelli Research Awards at the World Federation of Chiropractic's 12th Biennial Congress held in Durban, South Africa last April are:

i. On safety, a study from Quesnele, Triano et al.[3] reporting no changes in blood flow or turbulence in the vertebral arteries, a suggested potential source of injury, after chiropractic spinal manipulation. This confirms earlier research using Doppler ultrasound but is the first study using the more

accurate and sophisticated technique of phase-contrast MRI.

ii. On practice, new *Evidence-Based Guidelines for the Chiropractic Treatment of Adults with Neck Pain*[4] from the Guidelines Development Committee of the Canadian Chiropractic Association. These update earlier guidelines, incorporate all relevant literature until December 2011, make recommendations that support the main elements of chiropractic management, and become the most current and authoritative guidelines from the profession internationally.

In this issue we comment on these two new studies and place them in perspective. We summarize the overall evidence base, giving the evidence and arguments that support our opening statement – that manipulation and mobilization are now established as safe, effective, and appropriate treatments for neck pain and cervicogenic headache.

B. Best Management Approach

3. The study that commenced the fundamental change in management of patients with neck pain, from passive treatment for pain to active treatment to restore function, was the 1995 report titled *Redefining Whiplash and its Management* from the Quebec Task Force on Whiplash-Associated Disorders.[5] This was critical of traditional medical practice and prescribed this new approach to the management of patients with cervical spine soft-tissue injuries and neck pain:

a) Avoid rest, passive treatments, and use of a soft collar support – these approaches prolong pain and disability, and lead to chronic or long-term problems.

b) Reassure patients and keep them as active as possible. Use treatments that promote and support activity – specifically manual treatments (joint manipulation and mobilization, soft-tissue techniques) and exercises in combination with time-limited use of milder medications (NSAIDs, analgesics).

c) Avoid unproven therapies, including acupuncture, spray and stretch, transcutaneous electrical stimulation, ultrasound, laser, shortwave diathermy, heat, ice, massage, epidural or intrathecal injections, corticosteroid injections of the facet joints, muscle relaxants and psychosocial interventions.

4. Soon after the Quebec report two multidisciplinary texts edited by American doctors of chiropractic, Dr Craig Liebenson's *Rehabilitation of the Spine: A Practitioner's Manual (1996)*[6] and Dr Donald Murphy's *Conservative Management of Cervical Spine Syndromes (2000)*[7], provided a full description of this new active patient-centred approach to management.

As Liebenson explained, there must be "an integration of rehabilitation and manipulative therapy" which involves "a comprehensive analysis of the locomotor system" to understand the true causes of the problem and then "a specific prescription of manipulation and rehabilitation."

Ten years later, in his foreword to the second edition of Liebenson's text, Scottish orthopedic surgeon Dr Gordon Waddell cast an eye back over the past 10 years and said "so much that seemed revolutionary then is now accepted as the standard" for good spine care.[8]

5. **BJD Task Force.** The most authoritative current classification of neck pain and recommendations for management are those found in the 220-page report of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and its Associated Disorders published as a special supplement to SPINE and the European Spine Journal[9,10] in February 2008. This report represented seven years work from more than 50 researchers from 9 countries and 19 different clinical and scientific disciplines including chiropractic.

In his editorial on the Report as it was published Bjorn Rydevik MD, PhD, Deputy-Editor of *Spine,* explained that the Task Force "represented a unique gathering of international expertise" and observed:

"Considering the huge impact of neck pain on individuals, health care systems and society at large, and the lack of systematic knowledge in this field, the work by the Task Force represents a milestone achievement which will be of major significance and importance for patients, the medical profession, the health care system, researchers, research funding agencies, and insurance companies."[11]

6. **New Classification of Neck Pain.** The Task Force explained that all neck pain, including whiplash-associated disorders (WAD), should be classified into a common system with four grades as shown in Table 1. The great majority of patients have Grade 1 or Grade 2 neck pain. This new classification was designed to "help people with neck pain, researchers, clinicians and policy-makers in framing their questions and decisions."

7. **Treatments for Neck Pain.** Treatments chosen should be based on grades of neck pain. Most patients have Grade 1 and 2 neck pain and when choosing treatments "patients and their clinicians should consider the potential side effects and personal preferences."

For Grades 1 and 2 neck pain, treatments with similar evidence of safety and effectiveness and worth considering are: education, exercise, mobilization, manipulation, acupuncture, analgesics, massage, low-level laser therapy. The most effective interventions are those that "focus on regaining function".

The Chiropractic Report is an international review of professional and research issues published six times annually. You are welcome to use extracts from this Report. Kindly acknowledge the source. Subscribers may photocopy the Report or order additional copies (.80 cents each, plus shipping – minimum of 20 copies) for personal, non-commercial use in association with their practices. However, neither the complete Report nor the majority or whole of the leading article may be reproduced in any other form without written permission.

The opinions and statements in this publication are those of the individual authors alone, not the Editorial Board, World Federation of Chiropractic or any other organization.

Subscription: for rates and order form, see page 8.
- Visit www.chiropracticreport.com
- Call 416.484.9601
- Email us at TCR@chiropracticreport.com

Changes of mailing instructions should be sent to The Chiropractic Report, 203–1246 Yonge Street, Toronto, Ontario, Canada M4T 1W5, telephone 416.484.9601, fax 416.484.9665.
Printed by Harmony Printing Limited, 416.232.1472.

ISBN 0836-144

Table 1 BJD Task Force Classification of Neck Pain

Grade 1 *Neck pain with little or no interference with daily activities.* No signs or symptoms suggestive of major structural pathology and no or minor interference with activities of daily living; will likely respond to minimal intervention such as reassurance and pain control; does not require intensive investigations or ongoing treatment.

Grade 2 *Neck pain that limits daily activities.* No signs or symptoms of major structural pathology, but major interference with activities of daily living; requires pain relief and early activation/intervention aimed at preventing long-term disability.

Grade 3 *Neck pain accompanied by radiculopathy.* No signs or symptoms of major structural pathology, but presence of neurologic signs such as decreased deep tendon reflexes, weakness, and/or sensory deficits; might require investigation and, occasionally, more invasive treatments.

Grade 4 *Neck pain with serious pathology.* Signs or symptoms of major structural pathology, such as fracture, myelopathy, neoplasm, or systemic disease; requires prompt investigation and treatment.

Treatments "unlikely to help" and not supported by evidence for Grades 1 and 2 neck pain are: surgery, collars, ultrasound, electrical muscle stimulation, transcutaneous electrical nerve stimulation (TENS), most injection therapies, including corticosteroid injections in cervical facet joints, and radio-frequency neurotoxins (overheating of small nerves in the neck to suppress pain).

Whiplash-associated disorders (WAD) may fall into any of the four grades of neck pain – and should be assessed and treated according to grade.

There is no "best" treatment for neck pain that is effective for everyone and "trying a variety of therapies or combination of therapies may be needed to find relief".

Hurwitz, Carragee et al., summarizing the Task Force's best evidence synthesis on non-invasive interventions for the treatment of neck pain, suggest that "therapies involving manual therapy and exercise are more effective than alternative strategies for patients with neck pain." Low-level laser therapy "and perhaps acupuncture" are also more effective than no treatment, sham treatment, or alternative interventions. However none of these treatments "was clearly superior to any other either in the short or long term."[12]

8. **New Canadian Guidelines.** The recommendations of the BJD Task Force, proceeding from an international and multidisciplinary panel of experts acting independently from any one profession, rightly have broad credibility. However there is still an important role for profession-specific, evidence-based clinical guidelines developed on a national or international basis.

The new Canadian guidelines from Bryans, Decina et al. and the Guidelines Development Committee of the Canadian Chiropractic Association update 2005 guidelines, incorporate the literature to November 2011 and are now the foremost guidelines published by the profession in this area. The Council on Chiropractic Guidelines and Practice Parameters (CCGPP), the US national clinical guidelines organization sponsored by the Council on Chiropractic State Associations (COCSA), has a neck-pain literature synthesis which may be found at its website www.clinicalcompas.org, but this does not contain recommendations or guidelines. The one CCGPP recommendation on neck pain, found in a separate review of chronic spine-related conditions is: "There is moderate quality evidence that spinal manipulation/mobilization combined with exercise is effective for chronic non-specific neck pain".[13]

Byrans et al. note that since publication in 2005 of their original neck-pain guideline "the number and quality of clinical trials of chiropractic care has increased significantly". Their literature search produced 41 randomized controlled trials (RCTs) meeting their inclusion criteria, with strong methodology and "scoring a low-risk-of-bias." The recommendations they offer after their review and synthesis of the evidence are given the following strength ratings:

- **Strong –** consistent finding among at least 2 low-risk-of-bias controlled trials with no limiting factors.
- **Moderate –** consistent findings among at least 2 low-risk-of-bias controlled trials with minor limiting factors or 1 low-risk-of-bias controlled trial with no limiting factors.
- **Weak –** 1 low-risk-of-bias controlled trial with limiting factors.
- **Inconsistent –** Unresolvable differences between he findings of 2 or more low-risk-of-bias controlled trials.

9. **Chiropractic Management.** There is a summary of typical treatment modalities used by doctors of chiropractic for management of patients with neck pain, said to include "spinal manipulation, mobilization, device-assisted spinal manipulation, education about modifiable lifestyle factors, physical therapy modalities, heat/ice, massage, soft-tissue therapy such as as trigger point therapy, and strengthening and stretching exercises".

10. **Recommendations.** See the paper for details of all recommendations but these include:

a) **Acute Pain**

- Moderate recommendations are made for the treatment of acute neck pain with manipulation and mobilization in combination with other modalities.
- A weak recommendation is made for the treatment of acute neck pain with exercise alone.
- Thoracic manipulation and trigger point therapy are *not* recommended.

b) **Chronic Pain**

- Strong recommendations are made for treatment with manipulation, manual therapy and exercise in combination with other modalities.
- Strong recommendations are made for treatment with stretching, strengthening, and endurance exercises alone.
- Moderate recommendations are made for treatment with mobilization as well as massage in combination with other therapies.
- A weak recommendation is made for treatment with manipulation alone.
- Transcutaneous nerve stimulation, thoracic manipulation, laser, and traction are *not* recommended.

In summary there is now very good evidence for appropriate chiropractic management of patients with chronic neck pain,

continued on page 6

The Biopsychosocial Model Reviewed

continued from page 1

They conclude that the last 25 years have not seen improvement. Disability due to musculoskeletal disorders has increased by 45% from 1990 to 2010. Back pain is the leading cause of disability worldwide. Against the advice of guidelines there have been increases in tests and "in the provision of biological monotherapies that are costly and mostly ineffective."

They do not blame the model, but the failure to implement it adequately in research and practice. Problems include:

• Current practice and payment structures that give little incentive or reward to practitioners adopting the model.

• Training for most professions treating back pain that remains "biomedically focused and grounded in profession-specific tradition rather than on contemporary evidence."

Reviewing new and promising findings from the three components of the model they note:

• "Central nervous system sensitization and abnormal central processing of pain is emerging as an important biological explanation for the persistence of pain. There is even evidence that persistent back pain may alter brain morphology by reducing the volume of gray matter in the prefrontal area and the thalamus, and that such changes may be reversible once the pain is effectively treated. Such mechanisms may explain the small to moderate effects of numerous evidence-based treatments, despite their being assumed to have very different mechanisms of action."

• At a population level diagnostic imaging has demonstrated an association between the presence and severity of back pain and biological components (e.g. degree of disc degeneration, vertebral joint degeneration, vertebral marrow (Modic) changes, endplate lesions), but these findings "are not a useful way of diagnostically classifying individual patients, nor of informing treatment choice."

• There is good evidence suggesting that "psychological constructs such as pre-existing somatization, depression, anxiety, fear avoidance beliefs, poor coping strategies, and poor self-efficacy are significant predictors of outcomes such as more severe pain, greater functional disability, and work loss."

• Social factors, both at the individual and societal level, have a large impact and "are perhaps the most neglected area of research in back pain." Research on workers with chronic musculoskeletal pain has showed "that personal and work-related factors were more important than pain as determinants of work ability and staying at work." Overall the evidence suggests that "the less engagement and investment patients have with disability compensation systems, and the more they are supported in work resumption, the better their outcomes."

There is much else of interest. In summary, Pincus, Kent, Brontfort et al. conclude "the biopsychosocial model has not failed to explain back pain – what has failed is the mostly restrictive way it has been understood and applied."

(Pincus T, Kent P, Brontfort G et al. (2013) *Twenty-Five Years With the Biopsychosocial Model of Low Back Pain – Is It Time to Celebrate?* Spine 28:24;2118-2123)

World Notes

Asian Winners – World Spine Day

Congratulations to the Children's Chiropractic Foundation in Hong Kong and the chiropractic students at the International Medical University in Kuala Lumpur, Malaysia, first and second prize winners in the World Federation of Chiropractic's competition for activities on World Spine Day October 16.

World Spine Day (WSD), designed to attract attention to the significance, prevention and management of spinal disorders, is an annual event of the Bone and Joint Decade/Global Alliance for Musculoskeletal Health. For more on WSD and its significance for the profession, go to www.worldspinecare.org. For more on the WFC's WSD competition and its winning entries go to www.wfc.org and the December issue of the WFC's Quarterly World Report.

Hong Kong Children's Chiropractic Foundation at work on World Spine Day.

Canada – New Policy and Funding in Primary Care

In Canada's most populous province of Ontario, with a population of 13 million and some 3,500 doctors of chiropractic, Minister of Health Deb Matthews recently made the biggest policy announcement for the chiropractic profession in several years. Chiropractors will now be eligible for inclusion in the new government-funded, primary care networks being established across the province – and to which all primary care physicians must belong by 2020. This includes Family Health Teams and Nurse Practitioner-Led Clinics.

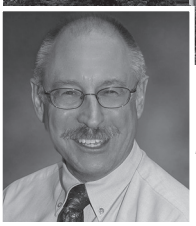
Currently there is extensive private insurance coverage for chiropractic services, and coverage is mandatory under automobile insurance policies and workers compensation. However there has been very limited provincial government coverage since former fee-for-service funding for some professions including chiropractic was removed in 2004.

Chiropractors will also be an integral part of a government Primary Care Lower Back Pilot Program being established and tested for improved management of back pain patients, announced

the Minister, a program then to be incorporated in the new primary care networks.

Malaysia

In October the International Medical University and its chiropractic program, which leads to a Bachelor of Science (Hons) (Chiropractic) degree, were granted accreditation by the Council on Chiropractic Education Australasia (CCEA). This was an historic occasion – the first full accreditation of the first chiropractic educational program in Malaysia. Congratulations to all involved. Head of the IMU Chiropractic Division during the past year is Dr Peter Diakow, a Canadian. Head prior to him was Dr Michael Haneline, an American. For more on IMU visit www.imu.edu.my.



Dr Peter Diakow

Dr Michael Haneline

Malta

The newest member of the European Chiropractors' Union, and applicant member of the World Federation of Chiropractic, is the Malta Chiropractic Association (MCA) led by Italian born Dr Nicolo Orlando (*right*) and representing Malta's four chiropractors.

Malta, one of the world's smallest and most densely populated countries, is an island of 360 km^2 located 80 km south of Sicily in the Mediterranean Sea. The two official languages are Maltese and English. The island's location as a naval base has given it great strategic importance throughout history. Today it is a favorite tourist destination because of its climate, recreational areas and architectural and historical monuments, which include seven UNESCO World Heritage Sites.

United Arab Emirates and Turkey

Thirty-two chiropractors from seven countries attended the Eastern Mediterranean and Middle East Chiropractic Federation (EMMECF) 2013 annual meeting and seminar in Dubai in the United Arab Emirates (UAE) on October 25-26. The UAE has 30 chiropractors, laws recognizing and regulating the practice of chiropractic and a growing Emirates Chiropractic Association (ECA) led by President Dr Mohamad Raslan, a graduate of Cleveland College in Kansas City.

One highlight of the national reports at the EMMECF meeting was a report from Dr Mustafa Agaoglu, President of the Turkish Chiropractic Association, that the Turkish government had now agreed to proceed with chiropractic legislation after he met with the Turkish Minister of Health at a WHO regional meeting in Turkey in September. Dr Agaoglu confirmed in December that that legislation has now been passed.

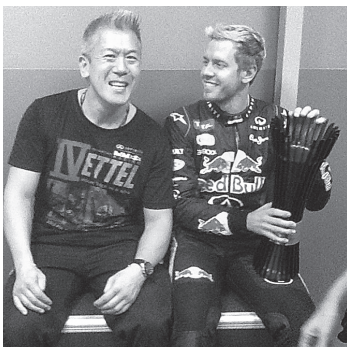
Another highlight was a visit to the Emirates European Medical Center, the impressive clinic of ECA Past President Dr Pamela Leader, to meet with His Highness Sheikh Manea Al Maktoum, a patient and a member of the Royal Family. Sheikh Manea expressed interest in supporting the development of chiropractic education in Dubai. As a first step he is hosting and funding a spine care symposium jointly organized by the ECA, EMMECF and WFC and to be held in Dubai on Saturday March 29, 2014.

*Dr Stathis Papadopoulos, EMMECF President (*front row, center*), Dr Mohamad Raslan (*next to Dr Papadopoulos*), and some of the other participants at the meetings.*

Formula 1 Motor Racing – Red Bull and Chiropractic

On October 27 Sebastian Vettel of the Red Bull Racing F1 team not only won the Indian Grand Prix but also his fourth consecutive FI World Championship Drivers Title. Red Bull Racing won the Constructors Title, again for the fourth consecutive time.

For the past six seasons British chiropractor Dr Paul Cheung has travelled the world to care for the Red Bull team – not only its leading drivers Sebastian Vettel and Mark Webber but also pit-crew mechanics, technicians and management. For more on how fit the drivers need to be, the scope of his work maintaining drivers and others in peak condition, and the excitement of Vettel's latest title see articles by Dr Cheung in the FICS News (December 2009 and December 2013) at www.fics-sport.org.



Dr Cheung celebrating with Sebastian Vettel in India, Vettel having just clinched his fourth F1World Championship Drivers' title.

but no individual treatment has strong evidence of effectiveness for patients with acute pain. However a combination of manual therapies and exercise has moderate to strong evidence-based recommendations for both. These treatments are directed at improving function and are at least as effective as any other. The guidelines make no recommendations on frequency or duration of treatment.

11. **Medication.** As prescription of medications is not part of chiropractic practice the Canadian guidelines have no research summary or recommendations for that. Medication, the first line of usual medical care, obviously offers some immediate pain relief, but is it an effective treatment in terms of lasting results? The evidence says no – it is not as effective as manual therapies and exercise, treatments which are directed at improved function as well as pain relief.

In a recent high-quality US trial by Bronfort, Evans et al.[14] 272 patients with acute and sub-acute neck pain (duration 2-12 weeks) were randomly assigned to one of three treatment groups:

a) *Chiropractic Manipulative Therapy (CMT).* Treatment was by six experienced chiropractors for a maximum of 12 weeks. Visits lasted 15-20 minutes each. Primary focus was "manipulation of areas of the spine with segmental hypomobility by using diversified techniques, including low-amplitude spinal adjustments and mobilization." Spinal level and number of treatments were left to the discretion of the clinician. Adjunct therapies common to clinical practice (e.g. light soft-tissue massage, assisted stretching, hot and cold packs and advice on activity) were allowed, but not exercises. There were an average number of 15 visits (range 2-23). In summary, participants in this group received something more than just SMT, but not the full scope of chiropractic services.

b) *Medication.* Medical care was given in a pain clinic. Visits lasted 15-20 minutes, and the focus of treatment was prescription medication. The first line of therapy was non-steroidal, anti-inflammatory drugs (NSAIDS), acetaminophen, or both. Narcotic medications and/or muscle relaxants were also used as needed, with choice of medications and number of visits at the discretion of the physician.

c) *Home Exercise and Advice (HEA).* Home exercise with advice was provided in 2 one-hour sessions by six therapists at a university-affiliated outpatient clinic. "The primary focus was simple self-mobilization exercise (gentle controlled movement) of the neck and shoulder joints, including neck retraction, extension, flexion, rotation, lateral bending motions, and scapula retraction, with no resistance." The program was individualized to each participant's abilities, tolerance, and activities of daily living. Participants were instructed to do 5 to 10 repetitions of each exercise up to 6 to 8 times per day. A booklet and laminated cards of prescribed exercises were provided.

Primary measurement of results was pain levels as self-assessed by patients on an 11-box numerical rating scale both during the treatment phase (at 2, 4, 8 and 12 weeks) and at 26 and 52 weeks (1 year follow-up). Secondary measurements included level of disability on the Neck Disability Index, objective measurement of cervical motion, extended medication use and satisfaction with care.

Each of the CMT (manipulation) and HEA (exercise) groups had superior results to the medication group during the treatment period and at 6 months and 1 year follow up. This was both statistically and clinically significant. CMT patients had the highest satisfaction with care.

When the New York Times reported the Bronfort, Evans et al. trial on January 3, 2012 its headline, warming the hearts of chiropractors but not pharmaceutical companies, was "For Neck Pain Chiropractic and Exercise are Better than Drugs." Asked for comment on television by ABC News Dr Lee Green, Professor of Family Medicine at the University of Michigan, said "It doesn't surprise me a bit. Neck pain is a mechanical problem, and it makes sense that mechanical treatment works better than a chemical one."

C. Safety

12. Very rarely following neck manipulation by a chiropractor, medical doctor, or other health professional, a patient suffers a vertebrobasilar stroke (VBS). In some instances this leads to permanent injury. Responsible estimates of the risk rate of VBS vary between 1 in 400,000 and 1 in 5.85 million treatments[15,16,17]. The figure most frequently given by experts is 1 incident in every 1 to 2 million treatments.

This risk rate can probably be better understood by most people, as Terrett explains, if it is described as one incident in a group of 25 chiropractors all of whom have practised for 40 years.[16]

This is such a low risk rate, in absolute terms and in comparison with medications and surgery given for the complaints typically treated with manipulation, that chiropractic and medical doctors and others using neck manipulation have traditionally not even mentioned it to patients. In recent years the new emphasis on patient rights and the law of informed consent have led to increased disclosure of this risk.

The argument that neck manipulation may be a cause of VBS depends upon two things – a close association in time between the treatment and the symptoms of stroke, and a biologically rational and plausible explanation. The postulated biological mechanism is injury to one of the two vertebral arteries in the upper cervical spine because of forces generated by the manipulation. Vasospasm or injury to the artery wall leads to interruption of the blood supply to the brain and thus stroke. More specifically the two suggested models or mechanisms of injury are:

a) Direct trauma to the wall of the artery producing tissue damage (dissection), followed by thrombosis and/or embolisation and thus obstruction of blood flow to the brain.

b) Lesser trauma to the artery, but sufficient to cause vasospasm, increased blood flow velocity beyond a point of constriction, turbulence, a local thrombogenic response, and VBS. Reasons this mechanism has been suggested include the known role of vasospasm as a major cause of harm to the vertebral and cerebral arteries in severe trauma, the rapid appearance of symptoms in some cases – which is hard to ascribe to a new injury to the artery wall, and transient ischaemic attacks.

13. **Injury to Artery Wall.** With respect to injury, Herzog and Symons[18] have demonstrated with fresh cadavers that forces actually reaching the vertebral artery (VA) from chiropractic manipulation are no greater than those produced by normal daily neck movements or normal range of motion tests. Maximum strain from manipulation is 11%, meaning that the relevant CO-C1 portion of the VA stretches 11% of its resting

(neutral) length. There is no tissue failure in, or damage to, the VA until it has stretched 53% over its resting length. Giving expert evidence subsequent to publication of this research Herzog explained:

- After this study it was his firm opinion that in normal circumstances a VA could not be damaged by cervical manipulation.
- For the average person the VA is stretched much more by normal daily movements of the head and neck than it is during neck manipulation – often twice as much.[19]

14. **Vasospasm.** Until now there have been few studies examining the effect of chiropractic spinal manipulation (CSM) on VA blood flow. These have used Doppler ultrasound and, although indicating no significant difference in blood flow for those who received CSM and others who did not, results have not been conclusive on whether CSM alters hemodynamics. Imaging is more obstructed and lacks resolution and detail in comparison with other and newer imaging techniques.

Phase-contrast magnetic resonance angiography has greater sensitivity and is presently considered the standard for diagnosis both of VBS and blood flow volume quantification. This explains the importance of the new study by Quesnele, Triano et al., the first using phase-contrast MRI, and reporting no significant changes in blood flow or velocity in the vertebral arteries of healthy young male adults after various head positions and cervical spine manipulation (CSM). With respect to this study:

- The purpose was to observe the changes in VA blood flow in healthy young adults in three neck positions and after CSM to help understand "the extent to which head/neck motion may interact with VA blood flow as a direct contributor to VBA stroke."
- Those studied were 10 healthy male adults aged 18-32 years – exclusion criteria included disabling neck, arm, or headache pain in the last six months and any history of neurologic symptoms.
- Differences in blood flow (in milliliters per second) and velocity (in centimeters per second) were measured by blinded examiners in three neck positions (neutral, 45 degrees rotation, maximum passive rotation) and after CSM. The paper gives details of the exact upper cervical manipulation, delivered by an experienced practitioner on the adjustable MRI bed. It was a rotatory manipulation at the C1/C2 level with the head repositioned at neutral immediately afterwards.
- Participants received the neck positions and manipulation in randomized order. The protocol included 30 minutes for each of the four events for each participant including:

i. 1 minute – holding neck position/manipulation plus neutral.
ii. 1 minute – replacing participant back into MRI bore.
iii. 20 minutes – anatomical images.
iv. 1.5 minutes – phase contrast imaging.

Imaging was at the C1-2 intervertebral level, was for both the left and right vertebral arteries, and quantified both peak and mean velocities and flows.

- There were no significant changes in blood flow or velocity in the vertebral arteries after the various head positions and the CSM. Largest recorded changes in flow and velocity were 7-9% in the contralateral VA. Quesnele, Triano et al. quote research indicating that "changes in peak velocity of greater than 25% from baseline" would be needed for clinical relevance.

15. **Association vs Causation.** The lack of significant force from manipulation reaching the VAs, and of any plausible biological mechanism for injury, suggest that VAS following manipulating is "associated with" rather than "caused by" manipulation. There is now convincing evidence supporting that:

a) In a large population-based study covering 109 million person years in Canada, the first ever to look at increased risk of stroke after both chiropractic and medical primary care visits, Cassidy, Boyle et al. report:

- There were only 818 cases of VBS from all causes – 7.5 per million person years. In other words this is a very rare form of stroke, not a large public health issue.
- The slightly increased incidence of stroke for those who had visited a chiropractor in the past 7 or 30 days compared with those in the general population, was exactly the same as for those who had visited a primary care physician during the past 7 or 30 days. This increased risk is likely due to patients with headache and neck pain from a VA dissection, the forerunner of stroke, seeking care prior to their stroke.[20]

b) There are now many reported cases of VBS following normal daily activities involving trivial neck movements, things such as walking, kneeling at prayer, turning the head while driving, painting the ceiling or engaging in dancing or sports. Further, there are many reported cases of spontaneous VBS – cases where the patient cannot recall any neck movement that precipitated the sudden symptoms of VA dissection and stroke such as severe neck pain, dizziness and nausea.[21]

c) Conversely, there are few reported cases after violent sporting activities such as boxing, mixed martial arts, downhill ski racing and football.

16. **Explaining Immediate VAS.** How do you explain patients who experience stroke in a chiropractic office immediately following an adjustment? The same way you explain cases where the patient has suffered VBS just before their first chiropractic appointment or while in the waiting room.[22,23] Any trivial motion can lead to stroke where there has already been damage to a vertebral artery and formation of a blood clot. In the words of Cassidy, Boyle et al. "a chiropractic manipulation or even simple range of motion examination by any practitioner could result in a thromboembolic event in a patient with pre-existing vertebral dissection".

17. **Causation and Diagnosis.** Rubenstein, Haldeman et al.[24] have presented a multifactorial model of risk for VA dissection and stroke, involving four necessary elements:

- Genetic predisposition/underlying familial disorder (e.g. connective tissue disease, hyperhomocysteinemia, vessel abnormalities)
- Environmental exposure (e.g. infection, oral contraceptive use)
- Trivial trauma (e.g. common neck movements, sporting activities, manipulative therapy to the neck)
- Common risk factors associated with atherosclerosis (e.g. hypertension, diabetes mellitus, smoking).

VAS is rare because a patient must have both an underlying predisposition and one or more necessary triggers. There is no guarantee that a competent history and examination will identify a patient at risk, but the above model does identify clues, and Kier and McCarthy have published this interesting "near miss" case:

• The patient was a 49 year old farmer with chronic episodic head and neck pain since the age of 19, not in severe pain, with unremarkable imaging and many things suggesting a mechanical origin for his problem and suitability for chiropractic adjustment.

• However, a careful examination revealed various risk factors and signs suggesting potential for cardiovascular disease – elevated blood pressure, family history of cardiovascular disease including stroke, bilateral tinnitus and nausea during severe attacks, reduced cervical range of motion in all directions during severe attack, and inability of the chiropractor to reproduce the patient's head pain during examination.

• He was referred to his general practitioner for further assessment prior to commencement of any chiropractic care, and the following week had a VA dissection and stroke leaving him hemiplegic and with speech impairment. As noted, a near miss.[25]

D. Conclusion

18. Notwithstanding the recurring outbursts of concern about the assumed risk of harm from cervical spine manipulation, this is now established as a safe, effective and appropriate treatment for patients with acute and chronic neck pain. As the new Canadian guidelines study notes, there has never been a single serious adverse event in all the trials of chiropractic manipulation.

State-of-the-art recommendations on neck pain and its management come from the 2008 BJD Neck Pain Task Force Report, endorsing and extending the principles of management set forth in 1995 by the Quebec Task Force. The focus of treatment should be restoration of function as well as pain relief, first line treatments include manual therapies and exercises, and putting patient preference at the centre of management is important and produces the best results.

This means, of course, that patients should be informed of appropriate treatments rather than being given no or inaccurate information about them. Given the research and new knowledge of the past decade it is not only unwarranted and unscientific that anyone would seek to ban cervical spine manipulation – it is clearly unscientific and against the best interests of patients. TCR

References

1 Norris JW, Beletsky V et al. (2000) *Sudden Neck Movement and Cervical Artery Dissection* CMAJ 163(1):38-40.

2 Sackett D, Testimony at Lewis Inquest, Coroner's Court, Toronto, November 20, 2002.

3 Quesnele J, Triano J et al. (2014) *Changes in Vertebral Artery Blood Flow Following Various Head Positions and Cervical Spine Manipulation* J Manipulative Physiol Ther 37:22-31.

4 Bryans R, Decina P et al. (2014) *Evidence-Based Guidelines for the Chiropractic Treatment of Adults With Neck Pain* J Manipulative Physiol Ther 37:42-63.

5 Spitzer WO, Skovron ML et al. (1995) *Scientific Monograph of the Quebec Task Force on Whiplash-Associated Disorders: Redefining Whiplash and its Management,* Spine 20:8S.

6 *Rehabilitation of the Spine: A Practitioner's Manual,* (1996) ed. Liebenson C, Williams and Wilkins, Baltimore.

7 *Conservative Management of Cervical Spine Syndromes* (2000) ed. Murphy DR, McGraw Hill, New York.

8 Waddell G (2007), Foreword in *Rehabilitation of the Spine: A Practitioner's Manual,* 2nd edition, ed. Liebenson C, Lippincott, Williams and Wilkins, Baltimore.

9 Haldeman S, Carroll LJ, Cassidy JD et al. (2008) *A Best Evidence Synthesis on Neck Pain: Findings From The Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders.* Spine 33(4S):S1-S220.

10 Haldeman S, Carroll LJ, Cassidy JD et al. (2008) *The Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders.* Euro Spine Journal 17 (Suppl.1):S1-S220.

11 Rydevik B (2008) *Editorial Preface: The Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders* Spine 33(4S):S3.

12 Hurwitz E, Carragee E et al. (2008) *Treatment of Neck Pain: Noninvasive Interventions.* SPINE33;4S:S123-S152.

13 Farabaugh RJ, Dehen MD, Hawk C et al. (2010) *Management of Chronic Spine-Related Conditions: Consensus Recommendations of a Multidisciplinary Panel* J Manipulative Physiol Ther 33:7;484-492.

14 Bronfort G, Evans R, Anderson A, et al. (2012) *Spinal Manipulation, Medication, or Home Exercise With Advice for Acute and Sub-acute Neck Pain* Ann Intern Med. 156:1-10.

15 Haldeman S, Kohlbeck FJ, McGregor M (2001) *Unpredictability of Cerebrovascular Ischemia Associated with Cervical Spine Manipulation Therapy: A Review of Sixty-Four Cases After Cervical Spine Manipulation*, Spine 27(1):49-55.

16 Terrett AGJ (2001) *Current Concepts in Vertebrobasilar Complications Following Spinal Manipulation*, NCMIC Group Inc., West Des Moines, IA.

17 Haldeman S, Carey P et al. (2001) *Arterial Dissections Following Cervical Manipulation: The Chiropractic Experience*, CMAJ 165(7):905-906.

18 Herzog W, Symons B (2002) *The Mechanics of Neck Manipulation with Special Consideration of the Vertebral Artery*, J Can Chiropr Assoc 46(3):134-136.

19 Herzog W, Testimony at Lewis Inquest, Coroner's Court, Toronto, November 26, 2002.

20 Cassidy DJ, Boyle E, Cote et al. (2008) *Risk of Vertebrobasilar Stroke and Chiropractic Care: Results of a Population-Based Case-Control and Case-Crossover Study* Spine 33(4S):S176-183.

21 Haldeman S, Kohlbekc FJ, McGregor M (2001) *Unpredictability of Cerebrovascular Ischemia Associated with Cervical Spine Manipulation.* Spine 27(1):49-55.

22 Lebouf-Yde C, Rasmussen LR et al. (1996) *The Risk of Over-reporting Spinal Manipulative Therapy-Induced Injuries: A Description of Some Cases that Failed to Burden the Statistics,* J Manipulative Physiol Ther 19:36-38.

23 Johnson CP, Lawler W, Burns J. (1993) *Use of Histomorphometry in the Assessment of Fatal Vertebral Artery Dissection.* J Clin Pathol 1993;46:1000-3.

24 Rubinstein SM, Haldeman S, van Tulder MW (2006) *An Etiologic Model to Help Explain the Pathogenesis of Cervical Artery Dissection: Implications for Cervical Manipulation.* J Manipulative Physiol Ther 29:336-338.

25 Kier AL, McCarthy PW (2006) *Cerebrovascular Accident Without Chiropractic Manipulation: A Case Report.* J Manipulative Physiol Ther 29:330-335.