

A Review of the Literature Regarding Stroke and Chiropractic

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Abstract — The purpose of this paper was to review the current literature on the topic of chiropractic adjustments (manipulations) having a causal relationship with cerebral vascular accidents (CVA.) A review and comparison of statistics of CVA occurrence in the chiropractic population with statistics of the general population, a comparison of injury rates of common medical procedures and activities of daily living to the rate of injuries that are related to chiropractic adjustments and a discussion of the validity of currently implemented CVA screening tests is performed. Current literature citations were retrieved from Medline, Chiroaccess (Mantis), The Chiropractic Clipping Service and the On Purpose audiocassette service. The literature was reviewed and statistics and information were analyzed to assess risk levels of chiropractic adjustments and to assess the validity of screening procedures. There have been many attempts made in the medical literature to show that chiropractic adjustments cause CVA's. Many of these statistics are falsely inflated by including statistics of injuries caused by people that are not chiropractors and yet referring to the procedures as chiropractic. The occurrence of CVA's in the general population is 0.224% while the occurrence of CVA's in the chiropractic population is 0.000008%. A person actually has a greater risk of getting hit and killed by lightning than having a (CVA) that is related to a chiropractic adjustment. Finally the current screening procedures that have been implemented to screen for CVA risk are unreliable and lack clinical soundness. The idea that chiropractic cervical spine adjustments cause CVA's has little support in the literature to validate it. Cervical adjustments are extremely safe, in fact much safer than all medical procedures explored in this paper and safer than many activities of daily living.

Key Words: Chiropractic, stroke, screening, vertebral artery, cervical spine, manipulation, cerebrovascular disorders, chiropractic adjustment

Introduction

Chiropractic was introduced to our society over one hundred years ago. Since that introduction, there have been high levels of adversity and animosity between the medical and the chiropractic community.¹⁻⁹ The fundamental differences in their philosophies and practice have resulted in everything ranging from Supreme Court cases and anti-medical propaganda from chiropractors to anti-chiropractic propaganda from the medical community.^{3,4,5,10,11,12} The problems between the two groups seem to

have stemmed mainly from the diametrically opposed nature of chiropractic and medical philosophy.

Chiropractic philosophy is based on four principals of bodily function and it's relation to health. The first principle is that the body is a self-healing organism. The second is that all bodily function is controlled and coordinated by the nervous system, and there is no experience or expression that is not processed through the nervous system. The third principle is that when there is interference within the nervous system it not only effects health, but it distorts perception and causes compromise to the body's ability to respond and react to the world and its physical, chemical and emotional stresses. The final principle is that through specific adjustments of spinal vertebrae which have misaligned and/or become fixated (termed a vertebral subluxation), chiropractors remove this interference from the nervous system.^{13,14}

Medicine bases its treatment on the philosophy of allopathy. Allopathy is a therapeutic system in which a disease is treated by pro-

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ducing a second condition that is intended to counteract the original disease. When the word allopathy is broken down to its root words, Allo- and Pathos-, it literally translates to "other suffering."¹⁵

In recent years there has been a dramatic increase in the popularity and utilization of chiropractic care in the general population.^{7,8,9,14,16,17} It is apparent when reviewing past information and comparing it with the present that with this gain in popularity there has been a subsequent rise in the amount of literature on the "dangers" of chiropractic care in the medical journals and in the media.^{5,18,19} Some of the information in this literature is valid while other information ranges from being either greatly exaggerated to simply false.^{5,18,20,21}

Relating chiropractic adjustments or manipulations to cerebral vascular accidents is a popular topic in many journals and in the media.^{5,17,18,20,21} There have been comprehensive literature reviews on this topic which show similar conclusions.^{1,3,4,6,7,17,21} However, there has not been a recent review of the past literature in conjunction with the most current information available. The intent of this paper is to review current literature and compare it to past studies, and present new and different perspectives with this current information. This review will also provide comparative statistical information on the risk of many commonly performed medical procedures and the risks of some everyday activities to give a realistic idea of the actual risk level of cervical adjustments.

Adjustment vs. Manipulation

It should be pointed out that many authors, especially in the medical community, use the term adjustment and manipulation interchangeably. This is a serious error since the two procedures are not identical and there are varying degrees of skill and specificity associated with their performance. Manipulation is defined as "The taking of a joint past its passive range of motion into the parapsychological space, but not past the anatomic limit, accompanied by articular cavitation. It is not synonymous with chiropractic adjustment which is applied to correct vertebral subluxation."²³

Adjustment is defined as: "The correction of a subluxation" and as "A specific directional thrust maneuver or application of forces applied to a subluxated vertebra that sets the vertebra into motion with the intent to reduce or correct the vertebral misalignment, thus improving the neurological component of the vertebral subluxation complex along with vivification of the affected tissues and body functions."^{23,24}

Chiropractic adjustments are applied to a specific segment and are further broken down to describe their amplitude and vector, the use of non, low or high force and may be applied using the hand or an instrument.^{23,24} These distinctions become crucial when one considers what type of health care practitioner (if any) is applying forces to the spine, the type and extent of training they have and what type of maneuvers they are applying. No health care professional currently receives the amount of training that a chiropractor does in manual procedures to correct biomechanical dysfunctions (subluxations).²⁵

Methods

In the process of researching the current literature for this paper four databases were utilized. The first was Medline, in

which multiple searches and search terms were used. The search terms included manipulation, adjustment, spinal manipulative therapy, stroke, cerebral vascular accident, adverse effects, adverse reactions, chiropractor and chiropractic. All combinations of these terms were explored as well. The only combination of terms that provided useful information was manipulation and strokes when limiting the search to 1999. The second database used was Chiroaccess (Mantis) where the same search terms were used and articles were only used from 1999. The third source was "The chiropractic clipping service." This is a clipping service provided by Dr. Robert Hoffman of Oyster Bay, New York and provides chiropractors with current articles from newspapers and magazines from around the country. The final source of information was the "On Purpose" monthly audiocassette subscription service. These tapes review current published chiropractic related literature and provide interviews with chiropractic leaders. All information that is discussed on the tapes is cited in a packet that is included with each tape set. The remaining citations and information were found in the bibliographies of articles that had been found in the previously listed databases.

Inclusion and Exclusion Criteria

Adjustments are sometimes referred to as "manipulations" which is a medical term for a similar physical action with a vastly different intent, purpose and level of specificity. However, since there is such prevalence in the literature of this misused term, studies that claim to discuss chiropractic manipulations and/or adjustments were selected even though there is an immense difference between the two concepts. Many of the studies not only misused the term manipulation but in some cases have actually misused the words chiropractic and chiropractor when referring to the person performing the "adjustment" (manipulation).^{5,18,20,21} In many cases, authors referred to any manipulation of the cervical spine as "Chiropractic" regardless of the training level of the individual who performed the manipulation. In reality, the delineation of a chiropractic adjustment and a nonspecific, untrained or medical manipulation should be simply that, an adjustment is chiropractic and a manipulation is not chiropractic. Unfortunately, in the literature, that delineation is not so simple.

Details of the Search

The first database searched was Medline. Search terms that were used included chiropractic, chiropractor, manipulation, adjustment, spinal manipulative therapy, stroke, cerebral vascular accident, adverse reactions and adverse effects. The only combination of these terms that provided any pertinent information was strokes and manipulation. This combination provided 77 hits, 7 of which were useful. The second database used was Chiroaccess (Mantis). This source provided 9 hits with the combination of stroke and manipulation and all were appropriate for review. The Chiropractic Clipping Service provided 3 articles that were appropriate for review. The final source of information were the On Purpose tapes. These tapes provided one source from an interview that was on a tape and led to two other articles that were quoted on the tapes and cited in the bibliography

packet included. Articles were included based on the title in most cases and of these articles chosen, few were excluded based on content of the article.

Review of Literature

Excessive Scrutiny and Misuse of the Literature

In recent years there has been a rise in the number of practicing chiropractors and a dramatic rise in the number of people in the general population who utilize chiropractic care.^{7,8,9,14,16,17,22} In 1999 the International Chiropractor's Association (ICA) estimated that there were 60,000 chiropractors in the U.S.^{12,22} This increase in the number of chiropractors and the increased utilization of chiropractic care brought on scrutiny by the medical profession.⁷ The aspects of chiropractic that the medical profession has shown the greatest concern over are chiropractic's efficacy and safety. This paper will concentrate on the safety of chiropractic.

In recent years, chiropractic has surpassed the critical mass index mark of 11% societal utilization showing that it is in fact a mainstream health care field.^{8,19} In 1997 people paid an estimated \$27 billion out of pocket for all alternative therapies with chiropractic placing in the top three alternative health care professions utilized and being paid for.^{8,19} This total dollar amount exceeded the amount of out of pocket expenditures for all hospitalization that year and was comparable to the total dollar amount paid out to all medical physicians. This dramatic rise in the popularity of alternative health care, with chiropractic at the forefront, seems to have the medical profession concerned.⁷ There has been an abundance of literature published in recent years that discuss the alleged dangers of chiropractic.^{5,18,19} In many of these articles, numbers and statistics have been falsely inflated by including statistics that are clearly not appropriate. It is reasonable to question the intent of the medical community's concern regarding the safety of cervical adjustments and manipulations considering the low incidence of injuries even by their own standards.⁷ One might question whether their concern is for the safety of the patient or for the economic impact on them from the increased utilization of so called "alternative" procedures.

There have been studies done in recent years that conclude that there is a causal relationship between manipulation of the cervical spine and cerebral vascular accident (CVA).^{5,17,18,20,21} Many of these studies base the conclusion that CVAs can be caused by a manipulation on the theory that when the neck is turned or twisted it may cause compromise to the vertebral artery and temporarily cut off circulation to parts of the brain and or damage the artery and cause an embolus.^{1,2,5,6,17,18,21} The majority of the literature that seems to point out the inherent dangers of chiropractic is in the form of case studies^{5,18} which are considered by some to be a weak form of scientific evidence. The review of literature studies, which are a stronger form of scientific evidence, seem to point in a direction that shows the safety of chiropractic adjustments.^{4,5,17,21} These same studies also suggest that even if there is a link, it is so minimal that it is almost not worth mentioning.

In the literature there is a lack of distinction between professions and different styles and techniques of manual procedures,

adjusting and manipulating.⁵ Medical doctors, osteopaths, physical therapists and chiropractors have different levels of expertise and levels of training in the area of spinal manipulation and adjustment. Although chiropractors perform approximately 94% of all spinal adjustments it is misrepresentation to include statistics of injuries caused by other professionals, and even non-professionals, and refer to the procedures as chiropractic in nature when clearly they are not.²² Despite the fact that the percentage of non-chiropractic practitioners that utilize manipulation as a procedure is so low, these practitioners and lay people seem to cause a vast majority of the injuries.⁴ In Australia for example, 100% of the deaths related to "chiropractic adjustments" (manipulations) were performed by medical doctors.⁴ A more disturbing fact is that in many of the statistics, not only are lesser trained professionals included, but in some cases there are completely untrained individuals included.^{5,18,20,21} Terrett published a paper in 1995 that discussed the misuse of the literature on this topic and found that in CVA statistics that were quoted as being "chiropractic" there were manipulations performed by a kung fu instructor, a blind, unlicensed masseur, a barber, a man's wife, and other assorted laypersons.⁵ With statistics that include the injuries caused by people that have absolutely no formal training in any spinal manual techniques and are obviously falsely inflated, it is understood why many chiropractors feel that these reports are specifically designed to reduce the number of people that visit chiropractors.^{1,2,3,10}

Relating Injury to Chiropractic

With most health care related injuries an exact cause of death or mechanism of injury can be arrived at through autopsy and or biochemical evaluation of involved tissue cells. However when a person has a CVA, determining the cause is not as easy. In fact many times the only way the cause of a CVA can be discovered is through speculation and a temporal relationship to a specific incident.²⁶ A temporal relationship is a very weak correlation because there can be many mitigating circumstances that may contribute to a person's condition and there may be many other underlying causes of a CVA. In most cases, when relating adjustments to CVAs, even the temporal relationship itself would barely be considered a coincidence by a reasonable person due to the possibility of large gaps of time between the adjustment and the onset of symptoms. An extremely weak correlation for a very serious charge leaves a large window of opportunity open for the possibility of subjectivity and false accusations.^{1,2,5} In reality, chiropractors have a very low incidence of malpractice litigation due to the fact that the amount of injury that results from chiropractors is so low. This is demonstrated by the fact that chiropractors pay very low insurance premiums on malpractice insurance. In 1996 3% of chiropractors were involved in litigation for malpractice while that same year 14.5% of medical doctors were involved in malpractice litigation.²⁷

Prevalence of CVAS in the U.S.

The American Heart Association has listed CVA as the 3rd leading cause of death in the United States with a total occurrence of approximately 600,000 CVA's per year resulting in

160,000 deaths.^{28,29} There are many causes and risk factors to make a person susceptible to having a CVA, some which are substantiated by the literature and some which are not.²¹ Some of the risk factors include gender, tobacco use, diabetes, major trauma, rotary head movements, swimming, yoga, and many occur with no precipitating event.^{10,21,29} However the idea that rotary head movements have a causal relationship with CVA is not substantiated by the literature.²¹ Some studies speculate and make assumptions that because a person's neck is put into a certain position, that there is comprise to the vertebral artery circulation and there is the opportunity for a CVA to occur.¹¹ The majority of the literature does not seem to concur with this hypothesis.^{4,11,17,30,31,32,33,34,35} Fortunately, regardless of the cause, a large majority of these CVA's are minor in severity and transient in nature.⁴

Prevalence of CVAS in Chiropractic

The total number of reported CVAs in the medical literature as of 1999 that were linked to cervical adjustments (manipulations) ranged from 115-177 cases in the United States since 1925.^{4,21,26,29} This range of incidence is extraordinarily low considering a conservative estimate of the number of spinal adjustments and spinal manipulations performed annually is 250,000,000.^{17,21} There have been 15 review of literature studies written between the years of 1963 to 1999 on the topic of CVA's and manipulation to find a ratio of how many CVA's are "linked" through a temporal relationship to a chiropractic adjustment.⁴ In these studies, there have been large ranges in the number of post-manipulative CVA's, ranging from 1 in 100,000 adjustments to 3 in 250,000,000 depending on the study.^{1,2,4,6,10,12,16,17,21} The average of all the ratios is 1 in 7,825,477 adjustments.^{1,2,4,6,10,16,17,21} Most of the studies that have more current information have higher ratios closer to 1 in 1,000,000 or 1 in 2,000,000 adjustments and in fact only one study had a ratio that was below 1 in 1,000,000 and that was 1 in 100,000.⁴

Overall, only about 41% of the people that have CVA's have any permanent damage while 18% do not survive the incident and the remaining third have complete remission of all symptoms.^{17,26} These recovery statistics apply to all CVA's and are not exclusive of any gender, mitigating circumstance, pre-existing condition or related incident (neck position or manipulation).^{17,26} This shows that even if one person out of 7,825,477 people has a CVA that can be correlated to a cervical manipulation or adjustment, that person still has a 30% chance of complete recovery from all symptoms.¹⁷ This suggests that even if there was an extremely minimal amount of risk involved with cervical adjustments there would be much less of a risk of any serious or permanent complications.¹⁷

The Safety of Chiropractic for the Pediatric Patient

Pediatric care is a rising segment of chiropractic practice with a significant proportion of all office visits being made by children.³³ Reasons for pediatric office visits to chiropractors include general health and wellness, birth trauma, respiratory dysfunction, enuresis, and a multitude of other conditions.³³ There have been an estimated total of 502,184,156 visits to chiropractors by

pediatric patients between 1966 and 1998.³³ In that time frame, there were only two documented cases of neurological complications that were linked to a chiropractic adjustment.³³ This shows that the chance of a neurological complication in a pediatric patient, a patient in the first decade of life, to be approximately 1 in 250 million and is obviously extremely safe. These two reported injuries have the same type of causal relationship as the adult cases, a loosely correlated temporal relationship, and there is still a 30% chance that all symptoms will completely resolve.^{17,33}

Occurrence of CVAS in the General vs Chiropractic Population

When discussing the occurrence rate of CVA's in a population of people that have received chiropractic adjustments or spinal manipulations it is important to compare this statistic to the occurrence rate of CVA's in the general population to assess if there is an increased risk. It can be argued that the occurrence of CVA's in the general population is actually significantly higher than in the population of people who receive spinal manipulation and or chiropractic adjustments.⁴ Every year 600,000 people have CVA's, 160,000 of which are fatal.²⁸ In 1998 the total U.S. population was approximately 268,396,000 which means that the percentage of people that had CVA's was approximately 0.224% of the population.^{28,37} The total number of people in the general population that received any type of spinal manipulation, including chiropractic, medical and untrained totaled 11% of the population or 29,523,560 people. Comparing this to the total rate of related CVA's, 2.36 per year, the percentage of injury is approximately 0.000008%.^{1,2,4,6,10,12,16,17,21,28,37} This could indicate that people who do not receive spinal adjustments are 27,500 times more likely to have a CVA than people that do receive spinal adjustments. Even if all the CVA's that have been related to spinal adjustments had occurred in that year the percentage would be 0.00005%, which is still 4,400 times lower than the general population. In other much more conservative estimates it has been calculated that the percentage can be as close as 0.00025% of CVA's in the chiropractic population and 0.00057% in the general population, which still shows that the general population suffers over two times as many CVA's as the chiropractic population.⁴ With risk levels this low and even lower than the general population, it is absolutely irresponsible for the medical community to condemn chiropractic adjustments or spinal manipulation when by their own standards the occurrence levels are so low and actually less than the general population. It has been estimated that if you drive 8 miles to the chiropractic office for an adjustment you have a statistically greater risk of being killed or seriously injured in a car accident than having a serious complication from a cervical spine adjustment.⁴

Risk

In every activity in which people take part there is a certain level of risk that is simply a reality of life. Different activities carry very different risk levels and we are constantly making decisions every minute of every day regarding what risk is worth taking.³⁸ With every decision there is a level of comparison between the benefit we derive verses risk of harm and a deter-

mination is made based on this factor.³⁸ Typically this is a two step process to determine what is safe. The first step is to make an objective assessment of empirical data. The second step is a subjective determination of the acceptability of the risk. When using this process it is absolutely paramount that a person has accurate objective evidence to make a correct and informed decision on any given action. It may also be helpful to have objective evidence from more familiar actions to compare the risk benefit ratio.

The Risk of Post-Manipulative CVA's vs. Common Medical Procedures

Reduction of neck pain and other musculoskeletal complaints after receiving chiropractic adjustments has been discussed in the literature.¹⁰ The first line of treatment administered by the majority of allopathic physicians for this type of condition are non-steroidal anti-inflammatory medications (NSAIDS).¹⁰ Chiropractors typically use adjustments to improve a patient's overall bodily function and one of the many benefits that is well documented in the literature is the alleviation of spinal and musculoskeletal pain.¹⁰ The literature shows that not only are adjustments of the cervical spine more effective, but they are much safer than NSAIDS.¹⁰ It is also well established that there are many dangerous and even fatal side effects that result from taking NSAIDS including gastrointestinal hemorrhage, gastrointestinal toxicity, dyspepsia, renal dysfunction, hypersensitivity reactions, liver damage, CNS damage, and anemia.^{4,10,26,39} In fact, this conservative "mainstream" medical approach of treating neck and musculoskeletal pain with NSAIDS is literally hundreds of times more dangerous than the chiropractic approach of administering spinal adjustments. A study run by the Canadian government to determine cost expenditures and treatment efficacy found that not only were chiropractic adjustments safe, effective and cost efficient but that they were literally the only treatment for back pain that was effective on a long term basis.⁴⁰ This report only focused on low back pain but stated that chiropractic was safe and effective for many other health problems and should not be limited to back pain.

Although it seems logical that long term use of NSAIDS would cause greater problems and be more of a health risk than short term use, it has been shown to the contrary.¹⁰ People who take NSAIDS for short periods of time actually run a greater risk of serious side effects than people who take this type of medication long term. Both long term and short term users of NSAIDS are at a significantly higher risk of death, three times greater than people that do not use them.^{4,10,39} In a retrospective study, it was shown that 80% of all ulcer related deaths were NSAID related.^{4,10,39} The current death rate that is attributed to NSAIDS is 0.04% while a conservative estimate of manipulation related injuries and deaths is 0.00025%.¹⁰

As dangerous as NSAIDS have been shown to be they are not a rarity in the pharmaceutical field. In addition, up to 51% of all medications that are commonly prescribed have serious and sometimes fatal side effects.⁴ Chiropractic has been scrutinized and criticized in the medical literature quite extensively for being unfounded and unscientific.^{10,12,41} With this level of criticism from the medical profession it is quite ironic that only about 15% of all medical procedures have been found to be supported by any literature at all and only 1% of that literature has actually been

deemed scientifically rigorous.^{10,12,41} Many medical procedures are not only unproven but many are never even tested.⁴¹ Since the 17th century there has been an average increase in the number of medical journals by 7% every year leading up to a total of 30,000 medical journals that are currently published.⁴¹ It is concerning that, with all the published medical information that is available, only 1% of all medical procedures are scientifically sound and that the medical profession attempts to hold all other health care professions to such high scientific standards.

Pharmaceuticals are not exclusive in being more dangerous than chiropractic adjustments. Many common medical procedures also have a much higher risk of death or serious injury.^{10,12,41} All medical procedures, including venipuncture, use of medication, vaccinations, and surgery have a certain level of risk.⁴ Many medical procedures and even many activities of daily living are significantly more dangerous than spinal adjustments.^{4,10} In 1994 deaths that were attributed to adverse drug reactions totaled 106,000 people making adverse reactions to properly prescribed and properly administered medications the fourth leading cause of death that year.⁴ Many common surgeries that are considered by the public to be safe have very high death rates. These include appendectomies which have a death rate of 1 in 74, and spinal fusions which kill as many as 1 in 50.4. Even procedures that seem completely benign, like a simple overnight stay at a hospital hold a mortality rate of 1 in 371 and venipuncture is 1 in 25,000 which is 400 times more dangerous than the alleged mortality rate of a cervical adjustment.⁴ The most surprising statistic is that the risk of getting hit by lightning is 1 in 200,000, ten times greater than the risk of a CVA related to an adjustment. The risk of being killed by that lightning strike is 1 in 2,000,000, which is about equal to conservative estimates of having a CVA that is related to an adjustment. Even with the mortality rates of common medical procedures being exponentially higher than the proposed dangers of cervical spine manipulation the public and the media do not seem to question medical philosophy or practices yet quite commonly question any alternative to medicine.

Screening Tests for Potential CVA Risk

Clinical screening tests are a useful tool for any health care field to help determine safety and appropriateness of a procedure or to help detect a condition in its pre-clinical stage for early treatment.¹¹ For a screening procedure to be considered useful it must be acceptable to the patient, be able to accurately detect a condition in its pre-clinical stage, and provide information that can improve the patient's health.¹¹ The tests that have been implemented as screening procedures in the chiropractic profession that claim to screen for cerebrovascular insufficiency such as Houles, Wallenbergs, DeKleins, Georges, and Hautants tests do not meet any of the criteria necessary for a procedure to be used in a clinical setting.^{11,17,30} The procedures that are currently implemented are not valid and have not been shown to give the necessary information to improve a patient's health or prevent injury.^{11,17,30} Scientific evidence suggests that the extension rotation tests are unable to do what they claim and do not give any indication if a patient is or is not at risk of having a CVA from vascular compromise.

There has been much controversy over the effects of rotation

and extension on the blood supply to the vertebrobasilar arteries.⁴² In many studies, contrary to current belief, it has been shown that no change in vertebrobasilar blood flow was caused by either neck extension, neck rotation or even from a cervical spine adjustment.^{11,17,31,32,33,34} Many of the studies that originally claimed these tests were valid were performed on animals and had extrapolated and generalized their outcomes to be true for humans and many of the outcomes shown to be true in animals have shown opposite outcomes in human subjects.³¹ A study performed on pigs showed a 20% change in blood flow velocity for 20–40 seconds after a manipulation was administered.³¹ While the same study showed that there was no change in humans, the authors stated that even if humans did have a change in blood flow as high as 20%, there still would not be any clinical significance. In another study there was an increase in peak flow velocity with cervical rotation which is the exact opposite outcome to the popularly accepted theory of vertebral artery compression and reduction of blood flow.³⁵ There have also been randomized, clinically controlled, double-blind studies that utilize doppler ultrasound which show that there is no change in the blood flow of the vertebral arteries during different head positions or even during or after an adjustment.³³ This clearly demonstrates that there is little basis for any correlation between CVA and manipulation. Further, there is no direct evidence in this research of an effect on the arteries sufficient to cause an injury or embolus to break loose. The idea of a cervical adjustment causing a CVA from a change in blood flow in the carotid arteries has been ruled out in the literature.¹⁰ Evidence shows there is no change in blood flow in the carotid arteries with any neck position, during or after an adjustment, and therefore has no effect on the blood vessel. Most of the literature suggests that there is no effect on the vertebral arteries either.^{11,17,31,32,33,42}

Many experts believe that not only are the current screening tests inappropriate but that they are actually unethical.^{11,30} There are many false positives that can prevent a patient from receiving care such as benign positional vertigo, Meniere's disease, labyrinthitis, vestibular neuritis, and many others.³⁰ Using a screening procedure that is unsupported, clearly unreliable, has multiple false positives and could potentially render misleading results, cause clinical confusion and cause unwarranted anxiety and alarm to a patient is unacceptable and irresponsible.^{11,30} Furthermore, if these screening tests did actually test what they claim to test, the doctor would be positioning the patient in the very position that is considered the highest risk to the patient.³⁰

Conclusion

In reviewing the current literature it is reasonable to conclude that there is no adverse connection between CVAs and chiropractic adjustments of the cervical spine to the level that warrants the extent of the attention the media and medical profession have shown. This can be shown on many different levels. The most compelling evidence are the studies that measured blood flow change in the vertebral arteries with neck position and adjustments (manipulation). These studies showed that there was no change in blood flow in the vertebral arteries during or after a manipulation or in any neck position. It was this type of experiment that originally ruled out the theory that a CVA could be

caused by damaging the carotid arteries with an adjustment. The carotid arteries are not affected by any neck position or adjustment and because of this fact it was shown that these arteries can not be damaged by these actions. It is reasonable to draw the conclusion that since the vertebral arteries have been shown not to be adversely affected by any neck position or an adjustment, that it is unlikely they can be damaged by an adjustment.

When reviewing and comparing the statistics of CVA's that are related to chiropractic adjustments and reviewing the occurrence of CVA's in the general population the results leave one wondering about chiropractors being accused of causing CVA's. The occurrence of CVA's in the general population is at minimum twice as common, to literally thousands of times more common, than in the population of people who see chiropractors depending on the study or set of statistics used. In either instance the fact is that the occurrence of CVA's appears to be much lower in the chiropractic population than in the general population. It would seem absurd to claim chiropractors are dangerous when the general population appears to be at a greater risk than people who get spinal adjustments from a chiropractor. Due to this fact it might even be reasonable to make the claim that chiropractors help prevent CVA's by helping enhance a persons overall bodily function.

The claim that chiropractic is unscientific and unsafe compared to medical interventions is ironic to say the least. It has been shown that even with the abundance of medical literature that is published, only about 15% of all medical procedures are supported by the literature and only 1% of these are scientifically sound. Not only are many medical procedures not tested but many are known to be extremely dangerous. This claim holds true for commonly performed surgeries, commonly prescribed medicines and common medical procedures. Chiropractic related injuries are typically one person in a few million at most and medical related injuries, for relatively simple procedures, have been known to be as high as 1 in 50 to 1 in 25,000 depending on the procedure. Properly prescribed and administered drugs kill 106,000 people every year. It has been suggested that more Americans are killed in hospitals every six months than died in the entire Vietnam War, that the medical death rate is equivalent to three jumbo jet crashes every other day and that the health care system may be a public health threat of epidemic proportions.⁴³ Many everyday activities and actions that people do not think twice about performing are much more dangerous than the alleged risk of chiropractic. It is actually more dangerous to drive 8 miles to a chiropractor's office than to get adjusted while you are there. It is quite obvious that chiropractic adjustments are safe when people use the analogy of getting hit by lightning for describing something that is extremely rare, and this actually runs a risk ten times greater than chiropractic adjustments.

CVA's are extremely common in our society, in fact they are the 3rd leading cause of death according to the American Heart Association and realistically could be related to any action. To say that 100% of all people that have had a CVA drank water in the days prior to the stroke would be absolutely true but to say that the water caused the CVA would be ridiculous. In any given year over 11% of people in our society get adjusted by a chiropractor and it should be expected that the rate of CVA's would be the same as the general population. This is not the case. In

reality the rate of CVAs in people that see chiropractors is between 27,500 to 4,400 times less than the occurrence in the general population.

When reviewing the literature on the screening tests that chiropractors have implemented to exclude people from care due to an assumed increased risk of CVA, it is clear that these tests are unreliable. It is sadly inappropriate to mandate unscientific screening tests which exclude patients from chiropractic care in an effort to appear scientific to the medical community. It has also been shown that it is extremely difficult for a physician to predict whether or not a person is at risk of having a CVA and therefore cannot reasonably be expected to advise a person on such matters with certainty.

There is a great amount of overlap between the terms manipulation and adjustment and it would seem that according to the literature a chiropractor is any person who can twist another person's neck and cause a "cracking" sound.^{5,18,19} This overlap of terms causes great confusion in describing the actual safety of chiropractic adjustments as opposed to the safety of anyone "cracking" someone else's neck. In any type of research there is typically a clear line drawn between what is being investigated and what is not being investigated. With chiropractic it appears that the line has been drawn to include any cervical manipulation regardless of who or how it is performed. Including statistics of manipulations not performed by chiropractors and referring to them as chiropractic is a sorry attempt by authors to inflate injury statistics to make a relatively safe and efficacious procedure seem dangerous to the public and health care professionals. Discussing the alleged dangers of chiropractic adjustments and including manipulations that are not performed by chiropractors and referring to them as chiropractic is completely misleading and clearly unethical.

Chiropractors are trained extensively in spinal adjusting to assess when and where specific spinal adjustments should be administered. To lay blame on the chiropractic profession for every injury that results from any individual "cracking" someone else's neck, or even their own neck, is as absurd as blaming all dermatologists for scars that resulted from teenagers popping pimples on their own faces. Including statistics of injuries in research papers that were not caused by chiropractors but were caused by medical professionals with different types of training and different levels of expertise is directly misleading.⁵ Including injury statistics that were a result of people with absolutely no formal training in spinal adjusting or even spinal manipulation is unethical. It is suggested that future investigators that evaluate the risks associated with chiropractic care are careful to define their terms along with defining the category of provider that has performed the offending procedure. To refuse to do so will only serve to scare patients who would otherwise benefit from properly applied care from the appropriate practitioner.

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