

**POTENTIAL VASCULAR COMPLICATIONS OF CHIROPRACTIC CERVICAL  
MANIPULATIONS: A REVIEW**A. Timucin Atayoglu\*<sup>1</sup>, Ayten Guner Atayoglu<sup>2</sup>, M. Ali Cetinkale<sup>3</sup> and Dr. KaleemUllah Rajput<sup>4</sup><sup>1</sup>Medipol University, Department of Family Medicine, Istanbul, Turkey.<sup>2</sup>Family Health Center, Kucukcekmece, Istanbul, Turkey.<sup>3</sup>Holistic and Integrative Medicine Association, Istanbul, Turkey.<sup>4</sup>St George's Hospital, University of London, Department of Integrative Medicine, London, UK.**\*Corresponding Author: Dr. A. Timucin Atayoglu**

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**ABSTRACT**

Chiropractic is a system of complementary medicine based on the diagnosis and manipulative treatment of misalignments of the joints, especially those of the spinal column. During the last decade, the use of such complementary therapies have increased considerably. In spite of its increasing popularity, there is limited understanding of the true risk involved in chiropractic. Safety has been debated and estimates vary widely for the incidence of serious adverse reactions of chiropractic manipulations. Vascular accidents account for the majority of criticism surrounding chiropractic cervical manipulations, although there is disagreement about their association. The aim of this review is to investigate the risk of vascular complications of chiropractic cervical manipulation and their predictability as well.

**KEYWORDS:** chiropractic, complementary medicine, complication, safety, cervical manipulation.**INTRODUCTION**

Chiropractic is a form of complementary medicine concerned with the treatment of mechanical disorders of the musculoskeletal system.<sup>[1]</sup> The main chiropractic treatment technique involves *manipulation* of the spine.<sup>[2]</sup>

Chiropractic practitioners often refer to spinal manipulation as an *adjustment*. It is the introduction of a high velocity and low amplitude thrust into a joint. It is often associated with an audible cracking sound caused by the breakdown of gas bubbles that form during joint cavitation. Joint manipulation is almost synonymous with Grade V mobilization that is a controlled process of articular and myofascial stretching to improve biomechanical elasticity.<sup>[3]</sup>

The spinal manipulation technique trace back to ancient China, Greece and Egypt<sup>[4]</sup> and today chiropractic manipulation is a very popular treatment choice for neck or low back pain.<sup>[5]</sup> It gained mainstream recognition in the 1960s, and its popularity for neck problems has increased since the publication of "Recommendations for Clinical Practice" in 1995 by the Quebec Taskforce that included the statement that "*a regimen of manipulation or mobilization can be used to treat patients with neck pain after whiplash injuries*".<sup>[6]</sup>

Chiropractic in general is considered as relatively safe when employed skillfully and appropriately,<sup>[7]</sup> but as with all therapeutic interventions, complications can arise.<sup>[7]</sup> The increased popularity of chiropractic cervical manipulation (CCM) has led to growing interest in determining the risk of these complications.<sup>[8]</sup> Therefore, safety has been debated and there is controversy regarding the degree of risk of such serious vascular complications after CCM.<sup>[9]</sup> Vascular accidents are responsible for the major criticism of CCM in the literature.<sup>[10-12]</sup>

The degree of serious risks associated with CCM is uncertain, with little evidence of risk of harm but also little evidence of safety.<sup>[13]</sup> However, CCM is believed to account for 6-9% of cervical artery accidents.<sup>[14]</sup> Several reports have linked CCM to dissection or occlusion of the vertebral basilar artery. Some have encountered cases of vascular events such as vertebral basilar accidents (VBAs) after manipulation. On the other hand, there is little doubt that there exists in the medical literature overreporting of such cases and a misunderstanding of what chiropractic techniques involve.<sup>[15]</sup>

Before the vertebral artery enters the base of the skull it changes in direction to a horizontal path and it has been hypothesized that cervical manipulation may cause

VBA. The cervical spine's range of motion is approximately 80° to 90° of flexion, 70° of extension, 20° to 45° of lateral flexion, and up to 90° of rotation to both sides.<sup>[16]</sup> Extension and rotation of the neck beyond the physiological range of motion might be the underlying mechanism of the complication.<sup>[17]</sup> In addition to cervical manipulation, VBAs have mostly occurred with a variety of reported causes such as turning the head while driving, coughing, lifting, and sporting injuries.<sup>[18]</sup>

In this review we aim to search the literature on safety issues of CCM, in particular, the risk of serious vascular complications and their predictability.

## METHOD

Relevant surveys, review articles and case reports were identified using a comprehensive search of online databases. There were no restrictions as to the language of publication. The data were validated and extracted accordingly, and vascular complications were grouped into two categories as VBAs and others such as ICAAs. On the bases of relevant literature, we attempted to enlighten further the understanding on the risks associated, the most frequently reported vascular complications and their predictability.

## RESULTS

To evaluate the safety of chiropractic procedures, Gouveia *et al.* performed a search on the articles that reported adverse reactions associated with chiropractic for the years 1966 to 2007. They concluded that there is no robust data concerning the incidence or prevalence of adverse reactions after chiropractic intervention.<sup>[22]</sup> Eder and Tilscher performed a survey of 168,000 neck manipulations without a significant serious vascular incident.<sup>[23]</sup> Henderson and Cassidy offered a report of more than a 500,000 manipulations at a chiropractic outpatient clinic in Canada without a serious vascular complication.<sup>[24]</sup> Jaskoviak reported approximately 5 million neck manipulations from 1965 to 1980 in Chicago / US, without any serious vascular complications.<sup>[25]</sup> Thiel *et al.* obtained data from more than 50,000 cervical spine manipulations in the U.K, and there were no reports of serious vascular adverse events.<sup>[26]</sup>

Although minor side effects following CCM are possible, the risk of a serious adverse event seems low. Estimates for serious vascular accidents vary from 5 events per 100,000 neck manipulations to 1 death per 4 million neck manipulations, though it was determined that there was inadequate data to be conclusive.<sup>[26]</sup>

In Switzerland, Dvorak, found a rate of 1 serious complication per 400,000 neck manipulations, without any reported deaths, among an estimated 1.5 million cervical manipulations.<sup>[15]</sup> In another survey in Holland, Patjin found an overall rate of 1 vascular complication in approximately 518,000 manipulations.<sup>[27]</sup> Haldeman *et al.* concurred that the risk of serious complications from cervical manipulation as low as being approximately 1-2

per 1 million neck manipulations.<sup>[28]</sup> Based on another survey by Halderman *et al.* for the 10-year period 1988 to 1997, estimated rate of VBAs after manipulation of 1 in about 5 million cervical manipulations.<sup>[29]</sup> In a survey done by Lee *et al.* neurologists in California were asked if they saw any neurological complications they thought resulted from chiropractic treatment in 1990-91. Their survey found 55 reported CVAs in about 50 million neck manipulations statewide.<sup>[30]</sup> Carey, based on malpractice history done in Canada over a 5 year period, concluded that estimate of risk is 1 serious complications per 3 million neck manipulations.<sup>[31]</sup> Klougart *et al.* sought to identify the cases of CVAs related to CCM that occurred in Denmark between 1978 and 1988 and concluded an estimated risk of 1 event of CVA per 1,320,000 cervical spine treatments sessions. The study also determined that the greatest risk is with particularly passive rotation of the neck as one CVA per 414,000 cervical spine sessions using rotation techniques in the upper cervical spine.<sup>[12]</sup>

Terrett found that the published medical literature contains reports of 126 cases of vascular accidents following manipulation reported in the international literature from 1934-1987, of which 29 cases resulted in death and estimate of the risk of death from stroke is about 1 fatality per 4 million cervical manipulations.<sup>[32]</sup>

In a review, the medical and chiropractic literature was conducted to summarize knowledge about CCM and the vast majority of the complications supposedly arising from CCM involved VBAs and the "one accident in a million" estimate was repeated.<sup>[19]</sup>

Ernst performed literature searches on case reports published between January 1995 and September 2001, containing data of adverse events after CCM and he found that VBAs causing stroke was reported in 18 cases.<sup>[33]</sup> In a 2007 review, he concluded that CCM can result in complications such as VBAs followed by stroke or death, but the incidence of such events is not known.<sup>[11]</sup> It is suggested that chiropractic care is a useful therapy for subjects with neck or low-back pain for which the risks of serious adverse events should be considered negligible.<sup>[34]</sup> According to a 2009 review by the same author, the risk-benefit spinal manipulation is not evidently favorable.<sup>[35]</sup> A comprehensive search was performed by Vohra *et al.* of electronic databases from inception to June 2004 including a study population of children and 9 cases involved serious adverse events.<sup>[36]</sup>

Another vascular complication reported other than VBAs is Internal Carotid Artery accident (ICAA).<sup>[19]</sup> According to Biller *et al.* there is a low evidence supporting an association between CCM and ICAAs<sup>[20]</sup> and the incidence of ICAA following CCM is unknown.<sup>[21]</sup>

## DISCUSSION

Although it is rare, CCM can result in serious complications.<sup>[7]</sup> However, it was determined that there was insufficient data to be decisive.<sup>[22]</sup>

The incidence of serious vascular risks associated with CCM is uncertain and dissimilar results have been published.<sup>[37]</sup> Some authors have reported that the association between CCM and vascular accidents is probable<sup>[29, 38]</sup> whereas according to others the causality is not strongly documented.<sup>[38]</sup> There is a lack of evaluation of safety profile of manipulation of the cervical spine, with little evidence of risk of harm but also little evidence of safety either.<sup>[13, 39]</sup>

According to some authors serious adverse effects of CCM are poorly reported. Resulting from the high levels of under-reporting in the literature, the actual incidence of serious adverse events may be unknown.<sup>[9,11]</sup> While it has been contended that the rate of vascular complications may be under-reported, it is probable that the rate of deaths are proportionally over-reported, since it is likely the more serious and impressive cases would be described in the literature. On the other hand, some authors suggest that the words chiropractic and chiropractic practitioner have been incorrectly used in numerous publications.<sup>[40]</sup> Therefore, in some cases this has led to improper judgement. In 1996, Coulter *et al.* convened a multidisciplinary group to evaluate the appropriateness of manipulation or mobilization of the cervical spine and according to the report only 11.1% could be labeled appropriate.<sup>[19]</sup> A panel of chiropractic practitioners and medical practitioners concluded that much additional scientific data about the efficacy of CCM are needed.<sup>[41]</sup>

It is also important whether the treatment is done by a licensed practitioner. The World Health Organization (WHO) guidelines suggest three major full-time educational paths culminating in either a DC, DCM, BSc, or MSc degree. Besides the full-time paths, they also suggest a conversion program for people with other health care education and limited training programs for regions where no legislation governs chiropractic.<sup>[7]</sup> Upon graduation, there may be a requirement to pass national, state, or provincial board examinations before being licensed to practice and continuing education may be required to renew these licenses.<sup>[42,43]</sup> A 1999 review<sup>[44]</sup> analyzed cases that were reported between 1925 and 1997 concluded that the literature does not demonstrate that the benefits of CCM outweigh the risks. It also concluded that no deaths have been attributed to CCM provided by licensed physical therapists. According to Kleynhans and Terrett, in experienced hands, CCM may give beneficial results with few adverse side effects.<sup>[32]</sup>

Some authors have suggested that VBAs related to CCM is an unpredictable event with no predictive indicators, while some others suggest that prediction of cerebrovascular events can be possible since the early

signs of arterial dissections include neck pain.<sup>[45, 46]</sup> Vertebral artery dissection can present with neck pain as the only symptom, thus leading the patient to consult a chiropractic practitioner. In some conditions it may be leading to dramatic consequences if a CCM is performed on an already-dissected artery.<sup>[47]</sup>

Marxt *et al.* evaluated all cases with the diagnosis of arterial dissection submitted between 1996 and 2005 to the Arbitration Board for Malpractice issues of Medical Associations of Northern Germany for assessment of the accusations brought against the therapists who conducted the manipulation.<sup>[48]</sup> They found that neither in majority of the carotid nor in the vertebral artery cases a causal link could be made between the dissection and the CCM. However, in most of the carotid and vertebral artery dissections there was clear evidence or high probability that the dissection was present prior to the manipulation, and had caused neck pain, segmental dysfunction and, in some cases, even neurological symptoms. Stroke after manipulative therapy was due to embolisation of thrombotic material from the dissected artery.<sup>[48]</sup> Simith *et al.* reviewed patients under age 60 with cervical arterial dissection and ischemic stroke or trans-ischaemic attack between 1995 - 2000, and showed that CCM is independently associated with vertebral arterial dissection, even after controlling for neck pain,<sup>[49]</sup> and these associations may be related to preexisting health conditions.<sup>[14, 32, 50]</sup>

The risks of CCM should be compared to the risks of other treatments for similar conditions. For example, the most common alternative treatment to CCM offered to patients with neck pain is prescription of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs). One study found an annual mortality rate of 4 per 10,000 for NSAID induced ulcers among patients treated for non-rheumatic conditions<sup>[51]</sup> and these complications are not limited only to chronic NSAID users.<sup>[52]</sup> In comparison to this, the mortality rate is 0.6 to 1.2 per 1,000 and the complication rate is 17.4 to 24.7 per 1,000 patients with Cervical Spine Surgery in the US.<sup>[53]</sup>

## CONCLUSION

Vascular complications of chiropractic manipulation of neck has still been a highly controversial issue. We need objective data on the relationship between CCM and vascular accidents. In addition to the published studies, data from the insurance companies which insures chiropractic practitioners can be used as a good source of statistics.

It is possible that there are significant numbers of chiropractic practitioners who have not passed the specialty examinations required and who are also not members of the Chiropractic Associations. It seems unfair to assess the risk of CCM as practised by well-trained chiropractic practitioners together with that associated with untrained ones. Practitioners should be invited to demonstrate the evidenced-based benefit of

CCM and to define the specific indications for which the benefits of intervention outweigh the risk.

All chiropractic treatments need a thorough medical history, diagnosis and plan of management. Chiropractic practitioner must rule out contraindications to CCM, including adverse events. Therefore, information should be gathered by the clinician to determine a potential vascular cause of the complain. If the suspicion of dissection is raised, ultrasound, MR angiography or conventional angiography should be performed.

The risk of vertebrobasilar complications contributes to the decision of practitioner on whether to perform cervical manipulation. Therefore we need clinical guidelines that aim to determine the cause of symptoms potentially associated with vertebrobasilar insufficiency and also to identify patients at risk of complications from manipulation.

This review has several limitations. Some relevant published articles might have been missed. High levels of under-reporting or recall bias might distort the overall picture generated. Some studies consist primarily of uncontrolled case series. We need population-based nested case-control studies to test the association.

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