



Case Report

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# Chiropractic Associated Vertebral Artery Dissection: Case Illustration and Literature Review

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Vertebral artery dissection (VAD) is a rare but serious safety concern associated with spinal manipulative therapy. This report highlights the occurrence of such condition in a 35-year-old male without predisposing risk factors. The patient has had dizziness and occipital pain of new onset following chiropractic for the neck spines. On admission, magnetic resonance angiography depicted a dissecting dilatation at the intracranial portion of the right vertebral artery. He was placed on antithrombotic therapy and fluid supplementation. His presenting symptoms completely remitted without recurrence. Follow-up images 4 months later showed resolution of the arterial dissection without progression to rupture. The study with featured images facilitates the physicians better understand VAD in those with neurologic complaints following chiropractic manipulation of the cervical vertebra.

**Keywords:** Chiropractic, Complications, Dissection, Vertebral artery, Vertebral artery dissection

## Introduction

Cervical chiropractic has been widely utilized in the population in order to relieve pains and stiffness in the neck. The therapy involves the application of controlled pressure to the spines with the goal of improving joint mobility and flexibility. Although accepted as non-invasive, this type of complementary medicine can cause various untoward reactions. In rare, cervical chiropractic care has resulted in the catastrophic damage to the vertebrae, vessels, and neural structures in the head and neck [1].

Arterial dissection (AD) refers to tears in the arterial wall that result in its dilatation or stenosis, with subsequent stroke in the territory of the affected vessel [2]. To provide timely and effective treatment, it is crucial to understand its causes, symptoms, and radiographies of the patient with cervicocephalic ADs. Vertebral artery dissection (VAD) is commonly thought to occur spontaneously, but physical trauma to the neck has been suggested as a trigger [3]. Only a few reports illustrated ADs related to the chiropractic maneuver for musculoskeletal conditions affecting the neck and upper back [4]. This report aims to present the clinical and imaging findings to help the clinicians manage the patients with VAD following cervical chiropractic.

## Case report

A 35-year-old male abruptly developed a severe occipitalgia following cervical manipulation in a chiropractic facility. The deep and sharp pain in the neck was followed by dizziness and vomiting. He often consulted his chiropractor

for muscle tension and restricted movements in the posterior neck. The therapist grasped the head to exert the axial tension, while rapidly mobilizing the neck with rotational and extending forces. In this session, the patient described his headache as a stabbing pain, worse than he had ever experienced before. He was referred to our emergency department for immediate medical evaluation.

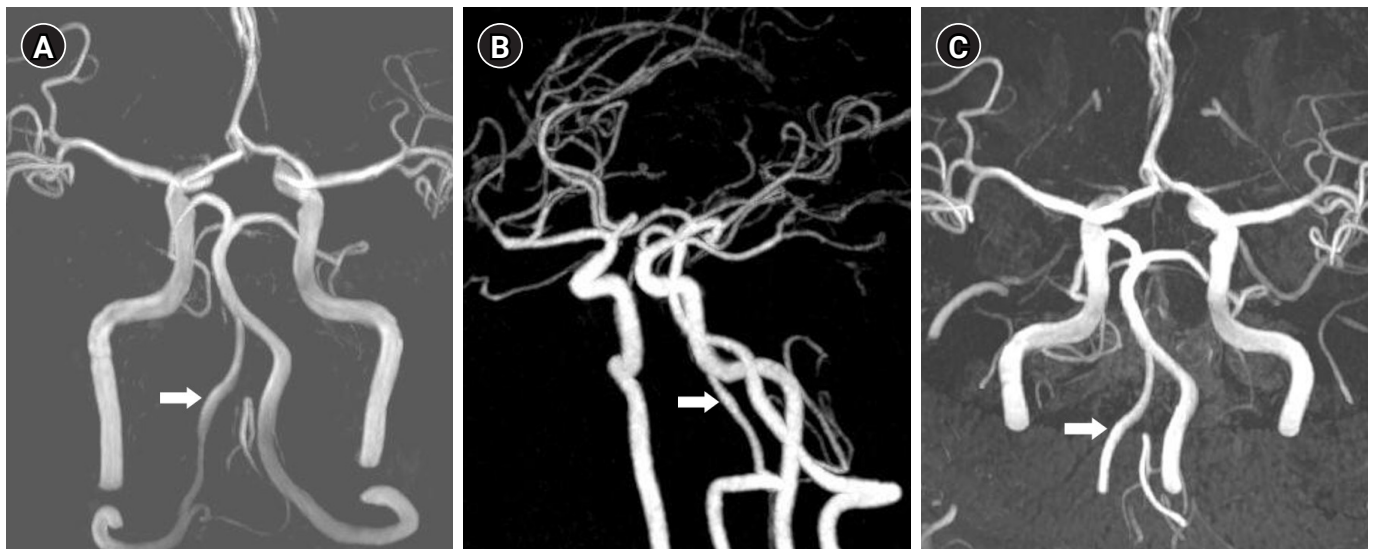
At admission to the hospital, he was still experiencing right-side neck pain and occipital headache. This patient was oriented and his vital signs were stable. Physical and neurological examinations were essentially normal. The patient was physically fit with no predispositions to stroke, no history of diabetes or hypertension, and no reported co-morbidities. He was not taking any medicines, and denied use of alcohol, tobacco, or illicit drugs. There was no abnormality in family history. While taking his history, we found that this young patient needed laboratory tests for connective tissue disorders, under suspicion of cervical arteries dissection. The values of anticardiolipin antibody, anti-Ro antibody, antinuclear antigen, anti-Sm antibody, anti-RNP antibody, lupus anticoagulant, and anti-Sc170 antibody were within normal ranges. Inpatient workups including serum stroke markers, echocardiogram, and holter monitoring gave no abnormal results.

X-ray revealed no evidence of spondylosis and fracture in the cervical spines. No acute lesions in the brain were found on magnetic resonance imaging. Initial magnetic resonance angiography (MRA) showed a smoothly tapering stenosis

with distal widening in the right vertebral artery (VA) near its junction to the basilar artery (Fig. 1A). The patient was intensively managed with intravenous hydration, analgesics, and dual antiplatelet therapy. This conservation was aid in the remission for presenting symptoms of dizziness and head and neck pains. Focal expansion related to VAD was stable in computed tomography (CT) angiogram on the 7th day of illness (Fig. 1B). Two weeks later after admission, he was discharged without any neurological sequelae. MRA performed 4 months after discharging disclosed a normal appearance of the previously dissected portion of the VA (Fig. 1C). Afterwards, the patient received acetylsalicylic acid for 15 months. He resumed his previous working duties and is living a healthy daily life.

## Discussion

Following cervical manipulations, the majority of the patients experience positive outcomes without major complications. However, some of them may complain of fatigue, muscle soreness, stiffness, and bruising around the treated area. Fortunately, these symptoms are mild and resolve within a few days [5]. In rare occasions, chiropractic can give rise to serious injuries, such as stroke, spinal hematoma, AD, cervical myelopathy, phrenic nerve palsy, retinal hemorrhage, vertebral dislocation, intracranial hypotension, and pathologic fractures [6].



**Fig. 1.** A case of vertebral artery dissection (arrows) related to neck chiropraxis. (A) On admission, magnetic resonance angiogram shows an involved dissecting segment with narrowing and dilatation in the right intracranial vertebral artery. (B) The dilated lesion was unchanged on repeated examination with computed tomography angiography. (C) The arterial configuration was restored at 4-months follow-up study by magnetic resonance angiography.

Once a dissection in the cervical brain-supplying arteries has occurred, the risk of thrombus formation, brain hemorrhage, ischemic stroke, limb paralysis, and even death is drastically increased. Spontaneous AD in the carotid and vertebro-basilar system has been well described in the references on strokes in younger generation [7]. The common risk factors are diabetes, low body mass index, hypertension, oral contraceptive pills, smoking, hyperhomocysteinemia, and connective tissue diseases [1,8]. For patients reported, the incidental neck trauma often precipitated this potentially dangerous neurological condition. The etiologies have been identified, including sport injuries, falls, traffic accidents, cervical fractures, physical exercise, and intravascular procedures [9]. This study reveals that cervical chiropractic can provoke the VAD in otherwise healthy young individual that resulted in subsequent cerebral ischemia.

VAD associated with cervical chiropractic is a rare clinical condition. Data on this adverse event of cervical manipulation are limited on the case reports [10]. The reviews showed that VAD following the therapy is possible even in those treated by standard technique. During the sessions, the provider usually performs a series of movements and adjustments to the neck using various modifications. This mobilization may involve a quick, thrusting motion, or a slower, gentle manipulation of the vertebral segments [11]. Pathophysiologically, vigorous or improper forces applied for chirotherapy can inadvertently produce significant strains on the cervical arteries. The mechanism is accepted that VA is stretched, compressed, or rotated beyond its range of motion, which potentially leads to intimal rupture and subsequent dissection [12]. The anatomical passing through transverse foramina also makes the VA susceptible to mechanical stress during cervical manipulation. The current case was immediately symptomatic by acute dissection of the VA that sufficient lead to compromise its blood flow to the posterior circulation of the brain. Consequently, patients undergoing the neck manipulation should be consented for risk of stroke or vascular injury from the intervention. In addition, controlled and gentle techniques to targeted areas of the spine refer to approaches that involve less force and minimal twisting or rotation of the neck.

While VAD is uncommon, physicians should consider it in those who have new or worsened symptoms following neck chiropractic. This event usually occurred in both males and females at an average age of 40 years [6]. Manifestations of manipulation-related VADs typically consist of headache, neck pain, dizziness, unbalance, vomiting, diplopia, nystagmus, dysphagia, dysarthria, hemiparesis, numbness, gait atax-

ia, and altered mentality. Adult patients frequently present with a complaint of sudden onset of new head and/or neck pain [2,4,8]. A relevant literature showed that 90% of patients had focal neurological defects and among these 11% had a reduced level of consciousness [13]. Accurate patient information and early recognition of the symptoms are important to avoid catastrophic. Unfortunately, however, initial presentations of the dissections might be very difficult to detect. Furthermore, VAD may ultimately lead to an infarct or hemorrhage which often can be delayed for days following its acute tears [14]. A systematic review found that clinical symptoms consistent with VAD started in 55% of patients within 12 hours following the neck manipulations [10]. In this case, cervical chiropractic preceded symptom onset by a few minutes, in the absence of preexisting conditions for AD. Notably, risk factors associated with ADs were present in a quarter of subjects for the prior studies. These factors included connective tissue disorders, hypertension, acute respiratory infection, history of migraine, arterial anomalies, trivial trauma, atherosclerosis, and variations in cervical vessel anatomy [5,11,12,15].

This report alerts both chiropractors and clinicians to be aware of VAD following cervical manipulations. Prior reports served as the example of cases with dissecting VA in progress seeking the chiropractic for their initial symptoms of the disease [16]. They highlighted the importance of paying attention to the subtle historical aspects in patients with VADs. It is also recommended that the chiropractors have to consult a healthcare professional if there are indications of prodromal symptoms or signs for VADs. Moreover, it is better to seek the medical attention based on the presence of potential risk factors of cervical spinal manipulation. From the cases reviewed, we can understand that pain in VAD may be localized to the back of the head, neck, or extend to the base of the cranium. Its severity and persistence can vary among individuals [2]. The second point to be mentioned is as follows. Chiropractic of the neck can cause mild headache or dizziness, which is usually short-lived and resolve on their own. This symptom is typically thought to be related to changes in blood flow or muscle tension. Resting and hydration often help relieve these untoward complaints [1]. Nevertheless, a significant increase in pain of the head and neck following chiropractic care warrants an immediate medical attention for proper evaluation and appropriate care.

The first step is seeking radiological studies to assess the location and extension of AD. For the present case, a focal stenosis and ectasia in the dissecting portion of intracranial VA was clearly demonstrated by an initial MRA. Modern imag-

ings, such as CT angiography, MRA, duplex ultrasound or conventional angiography, are commonly used to visualize the affected artery and identify any alterations in blood flow. The modalities characterize a double lumen appearance, intimal flap, intramural hematoma, steno-occlusion, a pearl and string sign, pseudoaneurysm formation or retention of the contrast medium [17]. As shown in this case report, regular follow-up imaging and close clinical monitoring are essential to assess the dynamic changes of the dissection and detect any potential complications.

Treatment for VADs following chirotherapy aims to prevent potential complications, address specific symptoms, and reduce the risk of embolization and further dissection. At first, analgesics are prescribed to alleviate neck pain and headache resulting from the dissection. Systematic review revealed that maintaining stable blood pressure is important to block excessive stress on the arterial walls with lesion [7,9]. The standard approach for hemodynamically stable patients with non-hemorrhagic VADs is antithrombotic medical therapy. Antiplatelet agents or anticoagulants could be used to suppress

thrombus formation and promote blood flow through the affected artery. For cases without significant stenotic or occlusive lesion, these conservations can be continued if the dissection is stable and not causing significant symptoms [18]. For all that, a follow-up angiography study must be performed during the early stage to confirm the formation or expansion of an aneurysm, because such conditions may be amenable to surgical treatment. In certain situations or if medical therapy is insufficient, minimally invasive procedures aim to repair or reinforce the damaged artery to restore normal blood flow with aid of balloons and stents [19]. However, surgical options such as bypass surgery or arterial reconstruction should be considered in selected and severe cases when endovascular therapy is unsuccessful or anatomically unsuitable. Prognosis in patients of chiropractic-related VAD varies depending on the extent of dissection, presence of associated complications, and early initiation of therapy [1,13]. Prompt management was instituted for this case, and then he had a complete resolution of unruptured VAD. In contrast, however, significant neurologic deficits or death from a massive stroke might occur in 5% to 31% of patients as a result of their VADs following the manipulation [9,10].

The chiropractors should be aware of cervical arteries dissections in the cases presenting with new onsets of neurological symptoms after manipulation for neck spines. From the neurosurgery perspective, the thorough medical evaluation, appropriate imaging study, and timely intervention are essen-

tial in managing patients who experience complications following this alternative therapy.

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## Ethics approval

This case was reviewed and approved by the Institutional Review Board of Keimyung University Dongsan Hospital (IRB No. 2023-02-026). The requirement for informed consent was waived by the board.

## Conflict of interest

The author has nothing to disclose.

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