American Journal of Clinical Case Reports

Case Report

# A Four-Vessel Cervical Artery Dissection Associated with a Tonic Seizure

*Biljana Georgievski Brkić[1], Marjana Vukićević[2], Tija Apostolović[3], Vuk Djulejić[4], Branka Marković[5] and Slobodan Marinković[6*]*

[1]*Department of CT and MRI, Sveti Sava Hospital, University of Belgrade, Serbia*

[2]*Department of Neurology, Sveti Sava Hospital, University of Belgrade, Serbia*

[3]*Department of Intensive Care, Sveti Sava Hospital, University of Belgrade, Serbia*

[4]*Department of Neuroanatomy, Institute of Anatomy, Faculty of Medicine, University of Belgrade, Serbia*

[5]*Faculty of Sports and Physical Education, University of Belgrade, Serbia*

[6]*Department of Neuroanatomy, Institute of Anatomy, Faculty of Medicine, University of Belgrade, Serbia*

## Abstract

The four-vessel cervical artery dissection is extremely rare. To our knowledge, its association with epilepsy has never been reported. A Computerized Tomography (CT) and CT Angiography (CTA) were performed in a 60-year-old patient who experienced a tonic seizure followed by right hemiplegia, right supranuclear facial weakness, dysphasia, and consciousness disorder. CTA revealed a dissection and occlusion of the left Internal Carotid Artery (ICA), a segmental occlusion of the left Vertebral Artery (VA), a hypoplasia, irregular luminal narrowing, and an occlusion of the right VA, as well as a dissection of the right ICA. Serial CT scans showed an infarction of the right occipital lobe and a larger ischemic region occupying most of the left occipital and temporal lobes, and some deep structures. The patient died, in spite of an intense anticoagulant and antiedema therapy. This could be the first patient reported with association of the four-vessel cervical artery dissection and a tonic seizure.

**Keywords: Arterial dissection; Cervical arteries; Occlusion; Stenosis; Cerebral ischemia; Brain edema**

## Introduction

The human brain is supplied by two paired vessels: the Internal Carotid (ICA) and the Vertebral Arteries (VA) (Figure 1). Dissection of their cervical or cranial segments is usually related to the intimal tear, which enables a penetration of blood under pressure into the vessel wall with a consecutive intramural hematoma formation [1,2]. The latter leads to a lumen narrowing or occlusion and a subsequent hypoperfusion or ischemia of the cervical spinal cord, brain, retina, or certain peripheral nerves [3-5]. Dissection in general is a rare event commonly occurring in between 1.5 and 3 individuals per 100,000 population annually [1,4]. Usually 1 or 2 cervical vessels are affected, infrequently 3, and extremely rarely both ICAs and VAs [6-26]. Among the 190 patients with cervical and cranial arteries dissection, enrolled at our Hospital during the last 10 years, a single patient with bilateral carotid and vertebral artery dissection was revealed, which is an exceptional event, particularly when associated with seizures.

**Citation:** Brkić BG, Vukićević M, Apostolović T, Djulejić V, Marković B, Marinković S. A Four-Vessel Cervical Artery Dissection Associated with a Tonic Seizure. Am J Clin Case Rep. 2021;2(1):1021.



**Publisher Name**: Medtext Publications LLC

**Manuscript compiled:** Jan 27th, 2021

***Corresponding author:** Slobodan Marinković, Department of Neuroanatomy, Institute of Anatomy, Faculty of Medicine, University of Belgrade, Belgrade, Serbia, Tel: 00381-11684259; E-mail: slobodan.marinkovic@med.bg.ac.rs; smarinkovic125@gmail.com

## Case Presentation

The 60-year-old patient was first admitted to a provincial Hospital for a tonic seizure manifested by abrupt contractions of the body musculature with an extension of the arms, legs and head, and consciousness disorder. This event was followed by dysphasia, hemiparesis, supranuclear facial weakness, and confusion. A CT examination was performed, which showed an ischemic area within the left occipital lobe. Since the consciousness disorder worsened two days later, he was transferred to our Hospital. The patient was admitted in a comatose state. The neurological examination revealed a right gaze deviation, a slower pupillary reaction bilaterally, right supranuclear facial weakness, and right hemiplegia. Laboratory analyses showed hyperglycemia and hyperlipidemia. The patient had a history of diabetes, dyslipidemia, hypertension, and cigarette smoking, but there were no signs of any hereditary disease, including a vascular collagen disorder. Since the patient had three grafts of aorto-coronary bypass placed two years ago, the echocardiography was performed. It showed blood pressure of 150/90 mm Hg, sinus rhythm, a heart rate of 82/min, a normal appearance of heart valves, atria and ventriculi, and a slight coronary insufficiency. The consciousness disorder was evaluated as 7 on the Glasgow Coma Scale, his stroke score as 27 on the NIHSS scale, and score 5 on the Rankin scale, respectively. A Computerized Tomographic (CT) examination was performed presenting ischemic areas within the right and left cerebral hemispheres. Since a vascular dissection was suspected, CT Angiography (CTA) was immediately undertaken, which showed a flame sign of the left ICA, i.e. a tapered occlusion at 18 mm from its origin (Figure 2). A similar occlusion was noticed in the left VA (Figure 2) which occupied its intradural (V3) portion, The right VA presented a hypoplasia, as well as multiple

luminal narrowing of the distal V2 and V3 segments, whilst the V4 portion was occluded (Figure 2). The cervical part of the right ICA was normal (Figure 2), but several luminal narrowing of its cavernous segment were noticed, compatible with dissection, which measured from 1.5 mm to 3.0 mm in diameter (Figure 3). Bilateral hemispheric infarctions were noticed in serial axial CT scans (Figures 4a through f). A large ischemic region of the left hemisphere occupied most of the occipital and temporal lobes. This massive ischemic areas involved the white matter and some portions of the cerebral cortex. In addition, the posterior part of the left thalamus and putamen were also affected, as well as a small part of the posterior limb of the internal capsule ipsilaterally. The ischemic region within the right hemisphere mainly occupied the occipital lobe. Signs of global brain edema were seen on CT scans as well. Due to such radiologic findings, anticoagulant and antiedema therapy was immediately introduced, whilst vascular surgery or endovascular interventions were not indicated due to the serious clinical state of the patient. However, in spite of intense medication, the patient died three days later.

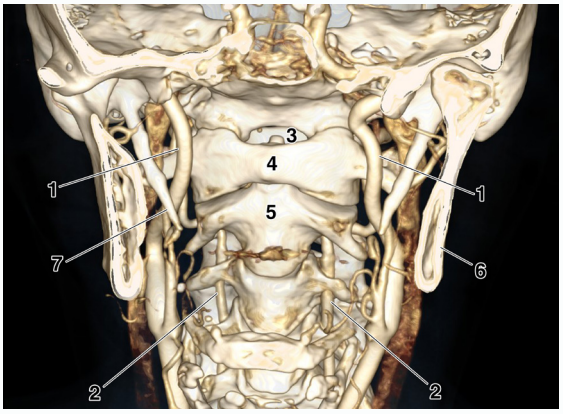


**Figure 1**: A coronal section of a 3D CTA image of the cervical arteries in a healthy individual. Note the right and left internal carotid arteries (1), and the right and left vertebral arteries (2). 3 – the foramen magnum; 4 – the atlas; 5 – the axis; 6 – the mandible; 7 – the styloid process.

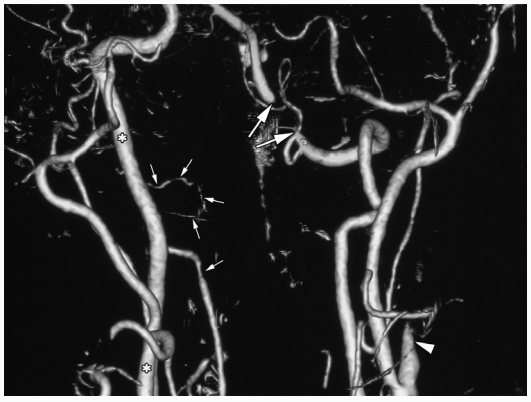

**Figure 2**: A 3D CTA image showing an occlusion of the initial part of the left internal carotid artery (arrowhead), an occlusion of the dural segment of the left vertebral artery (between the two larger arrows), and an irregular luminal narrowing of the hypoplastic right vertebral artery (smaller arrows). The cervical part of the right internal carotid artery is labeled by an asterix (*).

## Discussion

Most often a single cervical, cranial, or cervicocranial arteriy is affected by a dissection, and involvement of three arteries is very infrequent, whilst four-vessel involvement has been found extremely rarely [6-26]. For instance, two, three and four-vessel dissections were reported by Béjot et al. [7] in 15.2% of their 983 patients, and by Hassan et al. [6] in 22% of 76 patients. Arnold et al. [9] revealed a three-vessel dissection in 3 cases (1.5%), and a four-vessel in one (0.1%) within a group of 740 patients. All in all, a four-vessel dissection has been reported so far in less than three dozen patients (Table 1). We found a bilateral carotid and vertebral arteries dissection in one case (0.52%) among 190 patients. The cervical arteries were most often affected in these instances (Figure 2), and rarely the cervicocranial or intracranial vessels (Table 1), as noticed in the right ICA of our patient (Figure 2). In any case, typical radiologic signs were observed,

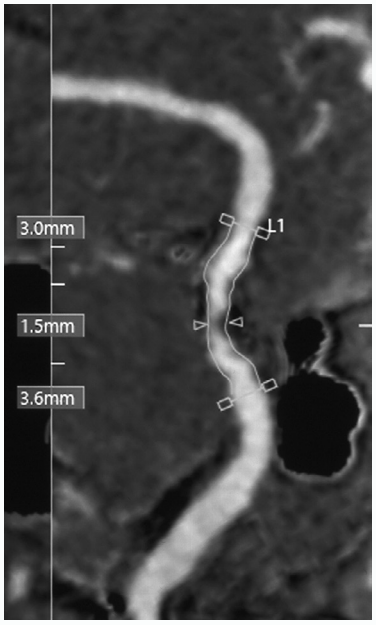


**Figure 3**: A CTA scan presenting a dissection of the cavernous segment of the right internal carotid artery. Note the luminal size measured in millimeters.

**Table 1:** Bilateral carotid and vertebral artery dissection in the literature.

| No. | Authors [References] | Age/Sex | Location | Cause |
|---|---|---|---|---|
| 1 | Abe et al. [16] | 52/M | Cervical | Spontaneous |
| 2 | Arnold et al. [9] | No data | Cervical | Spontaneous |
| 3 | Barroso & Demasles [18] | 39/F | Cervical | Postpartum |
| 4 | Béjot et al. [7] | No data | Cervical | No data |
| 5 | Chakrapani et al. [10] | 50/F | Cervical | Trauma |
| 6 | Chung et al. [19] | 44/M | Cervical | Trauma |
| 7 | Coss & Jones [17] | 23/F | Cervical | Trauma |
| 8 | Fukuda et al. [12] | No data | Cervical | Trauma |
| 9 | Golub et al. [11] | 49/F | Cervical | Spontaneous |
| 10 | Goyal et al. [20] | 28/F | Cervical | Postpartum |
| 11 | Hassan et al. [6] | 50/F | Cervical | Spontaneous |
| 12 | Keilani et al. [15] | 52/F | Cervical | Trauma |
| 13 | Koleilat et al. [23] | 23/F | Cervical | Trauma |
| 14 | Kutlu et al. [21] | 9/F | Cervical | Trauma |
| 15 | Leach & Malham [14] | No data | Cervical | Trauma |
| 16 | Marshman et al. [8] | 29/F | Cervical | Spontaneous |
| 17 | Őzkan Arat et al. [3] | 35/F | Cervical | Trauma |
| 18 | Rees et al. [2] | 43/M | Cervical | Spontaneous |
| 19 | Rudusky [22] | No data | Cervical | Trauma |
| 20 | Simon et al. [25] | 31/F | Cervical | Postpartum |
| 21 | Surpur & Govindarayan [24] | 36/F | Cervical | Drug |
| 22 | Yong & Heran [13] | 45/F | Cerv./Cran. | Trauma |

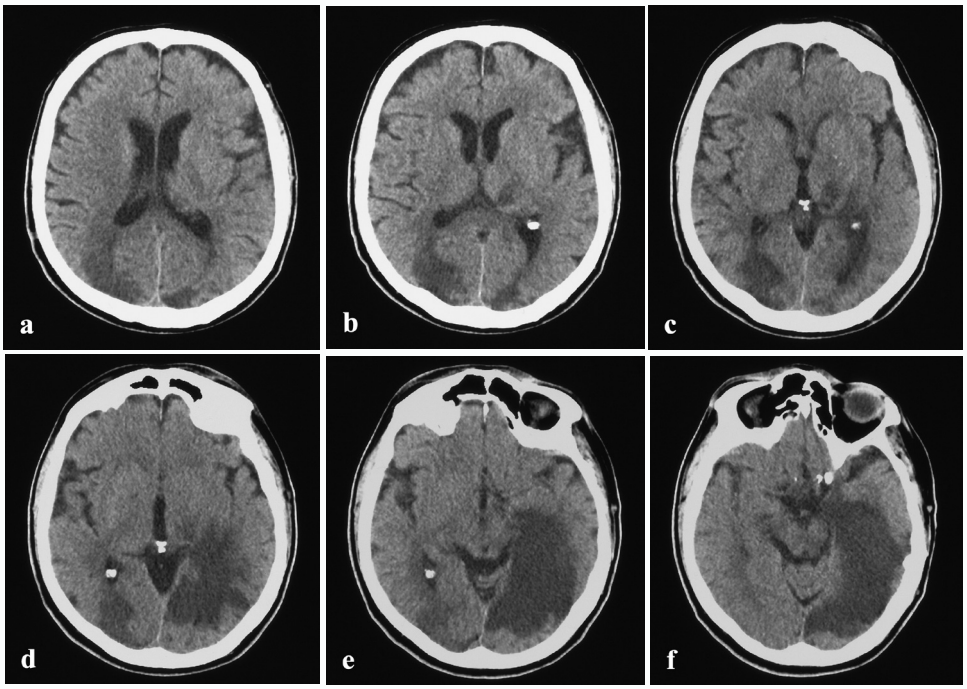


**Figure 4a-f:** Serial axial CT scans showing an ischemic area of the right occipital lobe and a large ischemic region of the left occipital and temporal lobes.

including an intimal tear, a flame type occlusion, or a string-and-pearl sign, i.e. irregular lumen narrowing of some arteries [1,4,5], as was the case with the right VA of our patient (Figure 2).

As regards causes and risk factors of dissection in general, usually blunt or mild trauma was noticed, as well as certain chromosomal or genetic anomalies, including connective tissue disorders, some infections, certain arteriopathies, migraine, hemodynamic changes, some drugs, iatrogenic injury, and pregnancy and the postpartum period [1,4,16,18,19,24,25]. Dissections without a certain cause are classified as spontaneous or idiopathic [1,2,4,6,8,9,11,16,20]. Similar factors were established in patients with a four-vessel dissection (Table 1). Most often a traumatic injury was noticed, i.e. in 50% (Table 1). Our male patient, aged 60 years, had no signs of connective tissue disease, or of hereditary disorders. However, he showed several important vascular risk factors, that is, hypertension, diabetes, hyperlipidemia, and smoking [1,4,19]. As regards the patient's epileptic seizure, tonic and tonic-clonic seizures, including status epilepticus, are extremely rarely associated with cervical arteries dissection and a subsequent brain infarction [26-30]. It is hard to determine whether a seizure was triggered the arterial dissection or it was a consequence of the four-vessel dissection in our patient without a history of epilepsy. If the seizure was a causal factor, muscle contractions are sufficiently strong to exert an abrupt compression and damage to the wall of the cervical arteries, and thus to lead to their dissection and brain hypoperfusion [29,30]. On the other hand, focal and global hypoxia or ischemia can result in extreme excitation and synchronization of the activity of some parts of the cerebral network and the spread of this abnormal electrical activity with a subsequent seizures appearance [30]. A three- or four-vessel dissection, like other situations with a brain hypoperfusion, may cause a global cerebral ischemia followed by brain edema [31]. This resulted in bilateral hemispheric infarctions in our patient. The left infarction (Figure 4) was larger than the right one due to a complete left ICA occlusion, and a segmental occlusion of the left VA. The ischemic region mainly occupied the territory of the left posterior cerebral artery, due to the collateral blood flow from the opposite ICA through the circle of Willis and from the external carotid artery, which was sufficient to compensate for the supply in the middle and anterior cerebral arteries territory (Figure 4). Other authors also noticed such a collateral blood flow [11]. As regards the right occipital infarction, it was mainly a consequence of a hypoplastic, stenotic and occluded left VA, and probably of an intracerebral steal of blood from the right hemisphere by the opposite hemispheric circulation, as noticed in some other patients [32].

## Conclusion

This is probably the first case of a four-vessel dissection associated with a tonic seizure. The extensive brain parenchyma injury and global cerebral ischemia were accompanied by global brain edema, which all caused deteriorating consequences in our patient. Delayed diagnosis and therapy of dissections also contributed to the lethal outcome.

## References

1. Robertson JJ, Koyfman A. Cervical artery dissections: A review. J Emerg Med. 2016;51(5):508-18.

2. Rees JH, Valentine AR, Llewelyn JG. Spontaneous bilateral carotid and vertebral artery dissection presenting as a Collet-Sicard syndrome. Br J Radiol. 1997;70(836):856-8.

3. Őzkan Arat Y, Volpi J, Arat A, Klucznik R, Diaz O. Bilateral internal carotid artery and vertebral artery dissections with retinal artery occlusion after a roller coaster ride - case report and a review. Ulus Travma Acil Cerrahi Derg. 2011;17(1):75-8.

4. Debette S, Compter A, Labeyrie MA, Uyttenboogaart M, Metso TM, Majersik JJ, et al. Epidemiology, pathophysiology, diagnosis, and management of intracranial artery dissection. Lancet Neurol. 2015;14(6):640-54.

5. Mehdi E, Aralasmak A, Toprak H, Yıldız S, Kurtcan S, Kolukisa M, et al. Craniocervical dissections: Radiologic findings, pitfalls, mimicking diseases: A pictorial review. Curr Med Imaging Rev. 2018;14(2):207-22.

6. Hassan AE, Zacharatos H, Mohammad YM, Tariq N, Vazquez G, Rodriguez GJ, et al. Comparison of single versus multiple spontaneous extra- and/or intracranial arterial dissection. J Stroke Cerebrovasc Dis. 2013;22(1):42-8.

7. Béjot Y, Aboa-Eboulé C, Debette S, Pezzini A, Tatlisumak T, Engelter S, et al. Characteristics and outcomes of patients with multiple cervical artery dissection. Stroke. 2014;45(1):37-41.

8. Marshman LA, Ball L, Jadun CK. Spontaneous bilateral carotid and vertebral artery dissections associated with multiple disparate intracranial aneurysms, subarachnoid hemorrhage and spontaneous resolution. Case report and literature review. Clin Neurol Neurosurg. 2007;109(9):816-20.

9. Arnold M, De Marchis GM, Stapf C, Baumgartner RW, Nedeltchev K, Buffon F, et al. Triple and quadruple spontaneous cervical artery dissection: presenting characteristics and long-term outcome. J Neurol Neurosurg Psychiatry. 2009;80(2):171-4.

10. Chakrapani AL, Zink W, Zimmerman R, Riina H, Benitez R. Bilateral carotid and bilateral vertebral artery dissection following facial massage. Angiology. 2009;59(6):761-4.

11. Golub D, Hu L, Dogra S, Torres J, Shapiro M. Spontaneous bilateral internal carotid and vertebral artery dissections with dominant-hemisphere circulation maintained by external carotid artery-ophthalmic artery anastomoses. Neurosurg Focus. 2019;46(2):E6.

12. Fukuda I, Meguro K, Matsusita S, Shigeta O, Oohashi N, Nakata Y. Traumatic disruption of bilateral vertebral arteries and internal carotid arteries: case report. J Trauma. 1989;29(2):263-6.

13. Yong RL, Heran NS. Traumatic carotid cavernous fistula with bilateral carotid artery and vertebral artery dissections. Acta Neurochir (Wien). 2005;147(10):1109-13.

14. Leach JC, Malham GM. Complete recovery following atlantoaxial fracture-dislocation with bilateral carotid and vertebral artery injury. Br J Neurosurg. 2009;23(1):92-4.

15. Keilani ZM, Berne JD, Agko M. Bilateral internal carotid and vertebral artery dissection after a horse-riding injury. J Vasc Surg. 2010;52(4):1052-7.

16. Abe A, Nito C, Sakamoto Y, Nogami A, Hokama H, Takahashi S, et al. Spontaneous bilateral cervical internal carotid and vertebral artery dissection in a Japanese patient without collagen vascular disease with special reference to single-nucleotide polymorphisms. J Stroke Cerebrovasc Dis. 2016;25(8):e114-7.

17. Coss C, Jones J. Bilateral carotid and vertebral artery dissection from blunt trauma. Case Rep Emerg Med. 2018:1919034.

18. Barroso B, Demasles S. Postpartum four-vessel cervical artery dissection. Cerebrovasc Dis Extra. 2013;3(1):150-2.

19. Chung SE, Yoon TH, Lee KM, Kim HG, Kim BJ. A case report of multiple cervical artery dissection after peripheral type facial palsy and use of steroids. BMC Neurol. 2018;18(1):74.

20. Goyal N, Male S, Doss VT, Arthur A, Elijovich L. Spontaneous dissection of the bilateral internal carotid and vertebral arteries: a rationale for endovascular management. J Neurol Sci. 2015;350(1-2):112-4.

21. Kutlu NO, Saraç K, Yakinci C. Dissection of bilateral internal carotid arteries and occlusion of both vertebral arteries in a child patient. Comput Med Imaging Graph. 2002;26(3):205-9.

22. Rudusky B. Response to facial massage and bilateral carotid and bilateral vertebral dissection. Angiology. 2009;60(4):519.

23. Koleilat I, Gandhi R, Boulos A, Bonville D. Traumatic bilateral carotid and vertebral artery dissection. J Emerg Trauma Shock. 2014;7(1):47-8.

24. Surpur SS, Govindarajan R. Extracranial four-vessel dissection with reversible cerebral vasoconstriction syndrome in a habitual cocaine user presenting with thunderclap headache. J Vasc Interv Neurol. 2017;9(5):54.

25. Simon EL, Griffin G, Bosman E. Bilateral carotid and vertebral artery dissection: a life-threatening cause of postpartum headache. Am J Emerg Med. 2015;33(4):e1–e3.

26. Young CA, Chadwick DW, Humphrey PR. Extracranial vertebral artery dissection following tonic clonic seizure. J Neurol Neurosurg Psychiatry. 1991;54(4):365-6.

27. Nunes-de Oliveira S, Moniz JC, Bandeira-Costa JC. [Status epilepticus, dissection of the vertebral artery and ischaemic vascular accident in the pons]. Rev Neurol. 2007;44(10):635-6.

28. De Reuck J, Van Maele G. Seizures in patients with symptomatic cervical artery occlusion by dissection and by atherosclerosis. Eur J Neurol. 2009;16(5):608-11.

29. Amin FM, Larsen VA, Tfelt-Hansen P. Vertebral artery dissection associated with generalized convulsive seizures: a case report. Case Rep Neurol. 2013;5(2):125-9.

30. Foldvary-Schaefer N, Wyllie E. Epilepsy. In: Christopher Goetz (Goetz CG) (ed). Textbook of Clinical Neurology. 3rd ed. Philadelphia: Saunders, Elsevier. 2007;1213-44.

31. Sanganalmath SK, Gopal P, Parker JR, Downs RK, Parker JC Jr, Dawn B. Global cerebral ischemia due to circulatory arrest: insights into cellular pathophysiology and diagnostic modalities. Mol Cell Biochem. 2017;426(1-2):111-27.

32. Hartkamp NS, Hendrikse J, de Borst GJ, Kappelle LJ, Bokkers RPH. Intracerebral steal phenomenon in symptomatic carotid artery disease. J Neuroradiol. 2019;46(3):173-8.