

Case Reports

# Spontaneous Right Intrapetrous Internal Carotid Dissection in a Patient With Active COVID-19

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## Abstract

Spontaneous cervical artery dissection, a nontraumatic tear in the wall of an internal carotid or vertebral artery, is a common cause of stroke, particularly in patients younger than 40 years of age; however, petrous internal carotid artery dissection is extremely rare. This case report describes a 50-year-old woman who had a spontaneous intrapetrous internal carotid dissection thought to be secondary to active SARS-CoV-2 infection; the dissection was treated successfully with a flow-diverter stent.

**Keywords:** Carotid arteries; dissection; aneurysm, false; COVID-19

## Case Report

**C**COVID-19, caused by severe acute SARS-CoV-2, predominantly affects the respiratory system but has a wide spectrum of clinical presentations. This article describes a case of a spontaneous right internal carotid dissection in a woman with active COVID-19 that was treated successfully with a flow-diverter stent.

### Medical History

A 50-year-old, non-Hispanic White woman presented with a history of mild hypercholesterolemia and 15 years of sporadic migraine headaches. Of note, her migraine episodes were successfully managed with over-the-counter medication. Two years before this presentation, she had had an episode of severe vertigo lasting about 2 months that she attributed to yoga.

In April 2022, the patient was exposed to multiple people who had tested positive for SARS-CoV-2 while traveling. On May 9, 2022, she tested positive by polymerase chain reaction for a non-Omicron variant but was asymptomatic at the time. The patient had not had COVID-19 previously and had received the full SARS-CoV-2 vaccination regimen, including 2 boosters of the Moderna vaccine between January 2021 and April 2022.

On May 10, 2022, she developed a mild, dull headache that became severe the next day. Her usual regimen to control migraine symptoms (3 doses of a combination of aspirin [400 mg] and caffeine [32 mg]) did not reduce the pain. The headache was accompanied by right-ear pulsatile tinnitus and vertigo, which were triggered by supine head movements. Over the next week, the pain extended to the right side of her neck and was aggravated on exertion. She went to the emergency department on May 19, 2022, and was prescribed a 5-day course of azithromycin (500 mg on day 1 and 250 mg for the remaining days) for a presumptive ear infection. Treatment did not resolve the symptoms.

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**Citation:** Noble O, Sprung K, Diaz O, Coulter S, Hernandez-Vila E. Spontaneous right intrapetrous internal carotid dissection in a patient with active COVID-19. *Tex Heart Inst J*. 2024;51(2):e248403. doi:10.14503/THIJ-24-8403

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## Presentation and Physical Examination

On May 26, 2022, the patient's physician detected a carotid bruit. The patient had no family history of relevant vascular disease. Her blood test results showed normal fasting glucose, serum iron, and ferritin levels. Bilateral duplex carotid artery ultrasonography of the cervical carotid arteries revealed no significant occlusive disease of the common and internal arteries. Maximum velocities in the right common carotid artery and the right internal carotid artery were 105/26 cm/s and 66/20 cm/s, respectively. Maximum velocity was 116/23 cm/s in the left common carotid artery and 109/18 cm/s in the left internal carotid artery. Both the right and left vertebral arteries had normal antegrade flow. The subclavian artery had normal multiphasic flow. Because of concerns for intracranial vascular involvement, noncontrast magnetic resonance angiography was conducted, which showed a focal dissection with luminal irregularity, an intimal flap, and moderate to severe luminal stenosis of the distal right cervical internal carotid artery and right petrous internal carotid junction (Fig. 1).

## Technique

The patient was referred to neuroradiology and prescribed 75 mg clopidogrel and 81 mg aspirin. On June 7, 2022, the patient underwent a femoral access diagnostic



**Fig. 1** Noncontrast magnetic resonance angiogram showing dissection (white arrow) at the right internal carotid artery, with an intimal flap and moderate to severe luminal stenosis involving the distal right cervical internal carotid artery and right petrous internal carotid junction.

## Key Points

- Clinicians should consider spontaneous carotid artery dissection in young patients with neurologic symptoms who have or have recently had COVID-19.
- Spontaneous carotid artery dissection is a common cause of stroke in the younger adult population (mean age, 45 years), with a prevalence of 20%.
- Spontaneous intrapetrous segment internal carotid artery dissection is rare because the petrous bone protects this segment.
- Evidence suggests that the incidence of spontaneous carotid artery dissection has increased in young patients since the beginning of the COVID-19 pandemic, despite a paucity of risk factors.
- Conservative treatment is often recommended as first-line therapy for stable asymptomatic patients with cerebral artery dissection; endovascular or, rarely, surgical treatment is reasonable for individuals with persistent symptoms.

angiogram that confirmed a complex dissection of the petrous segment of the right internal carotid artery, associated with 70% stenosis and a 9-mm pseudoaneurysm (Fig. 2A, 2B). A conservative strategy was initially adopted.

## Outcome

On June 21, 2022, because of continued symptoms, a Pipeline Flex embolization device (Medtronic)—a flow-diverter stent (Fig. 3)<sup>1</sup>—was placed via femoral access that resolved her symptoms (Fig. 4A and 4B).

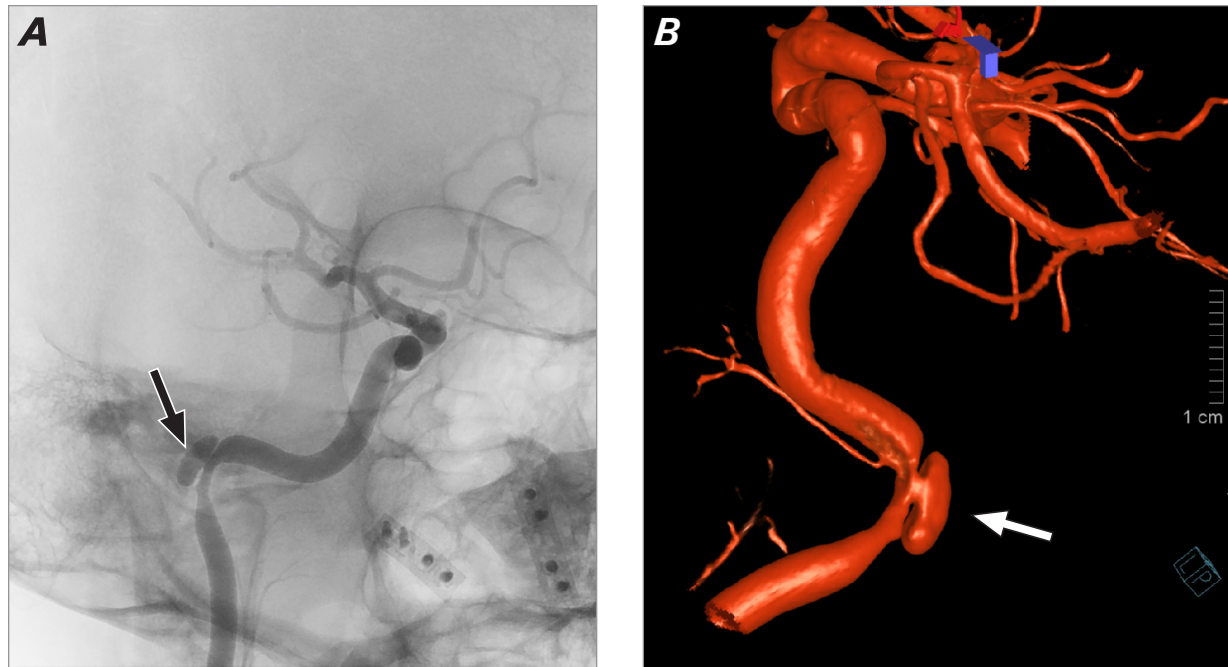
## Latest Follow-Up

Repeat angiography at 6 months showed complete resolution of the dissection and stent patency (Fig. 5).

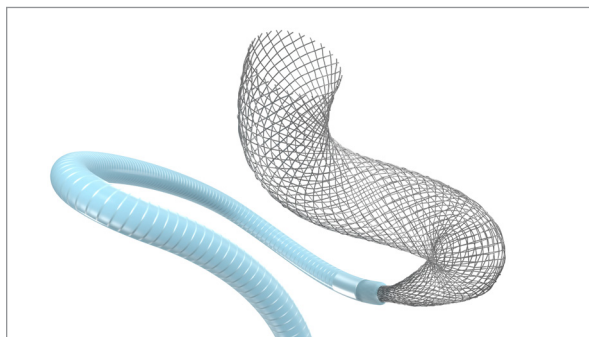
## Discussion

Spontaneous carotid artery dissection has a prevalence of 20% in stroke occurring in young adults (mean age, 45 years). The most common presentation of spontaneous carotid artery dissection is extracranial internal carotid dissection, which accounts for up to 2.5% of all first strokes.<sup>2</sup> Involvement of the intrapetrous segment of the internal carotid artery is rare, however, because the segment is protected by the petrous bone.<sup>3</sup>

Spontaneous carotid artery dissection can be classified by the affected blood vessel (cervical or carotid) and the anatomical location of the dissection (intracranial or extracranial). It results from the separation of the arterial wall layers, most commonly the intimal layer,



**Fig. 2 A)** Right cerebral angiogram demonstrating complex dissection of the vertical segment of the petrous right internal carotid, associated with 70% stenosis and pseudoaneurysm measuring 9 mm × 5 mm and a linear filling defect associated with an intraluminal flap (white arrow). **B)** Right cerebral angiogram with 3-dimensional rotational views and syngo DynaCT (Siemens Healthineers) with diluted contrast (white arrow).

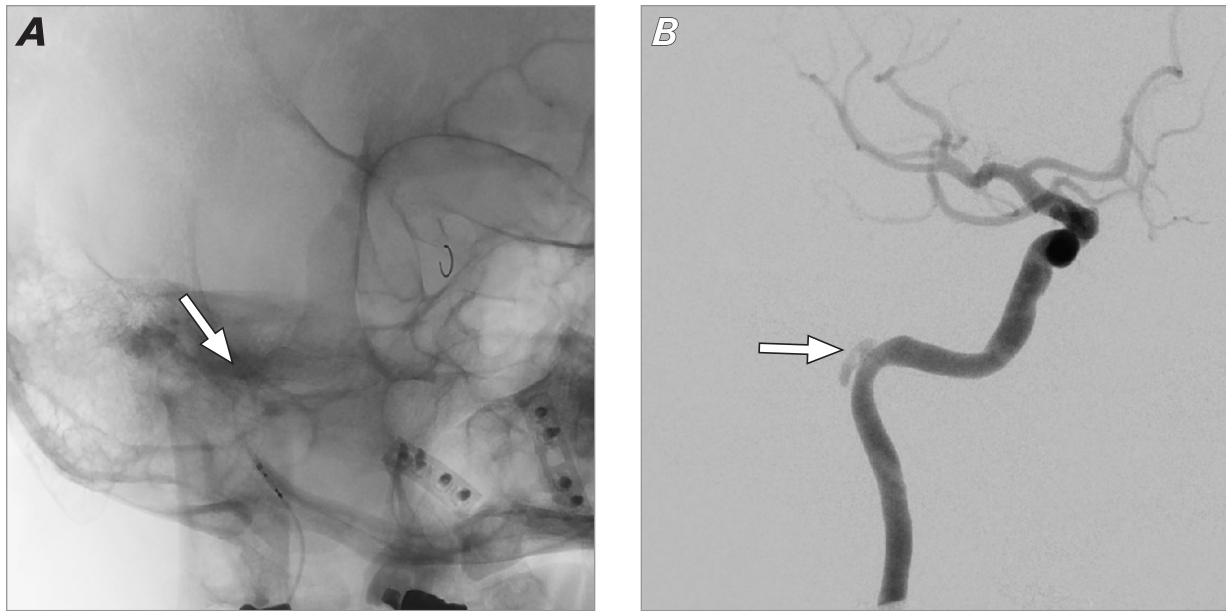


**Fig. 3** Pipeline flex embolization device. ©2023 Medtronic; reproduced with permission of Medtronic.<sup>1</sup>

and can compromise blood flow to the brain, leading to stroke and complications such as hematomas and pseudoaneurysm formation. Clinical presentation of spontaneous carotid artery dissection can vary and is challenging to diagnose because of the extensive cervical arterial branches, the location of dissection, and the diverse cranial structures irrigated. The most common clinical symptoms are nonspecific headache, which can mimic migraine, and ipsilateral neck pain. Partial Horner syndrome and retinal or cerebral ischemia are strong predictors of a cervical artery dissection. Spon-

taneous carotid artery dissection can have both spontaneous and traumatic etiologies. The risk factors for a spontaneous cause are hypertension; family history of spontaneous carotid artery dissection; and connective tissue disorders such as Marfan syndrome, osteogenesis imperfecta, fibromuscular dysplasia, and Ehlers-Danlos syndrome. There is evidence of a seasonal fluctuation in the incidence of spontaneous carotid artery dissection, suggesting that autumn and winter infectious diseases could be a possible risk factor for spontaneous carotid artery dissection. This finding suggests that nonsevere SARS-CoV-2 infection could be a driver of spontaneous carotid artery dissection.<sup>4</sup>

Since the beginning of the COVID-19 pandemic, the incidence of spontaneous carotid artery dissection has increased in young patients, despite the lack of risk factors.<sup>5-10</sup> SARS-CoV-2 infection affects primarily the upper and lower respiratory systems and causes a wide range of clinical manifestations, such as olfactory nerve damage, mucosal inflammation, alveolar destruction, and pulmonary consolidation. The infection is not limited to the respiratory system because the virus uses the angiotensin-converting enzyme 2 receptor for entry into cells and transmembrane serine protease 2 downstream



**Fig. 4 A)** Angiogram showing flow-diverter stent during deployment across the dissection (white arrow). **B)** Final angiogram after flow-diverter stent placement showing successful treatment of the dissection, with a substantial decrease in flow into the false lumen and restoration of unobstructed antegrade flow (white arrow).



**Fig. 5** Angiogram at 6-month follow-up showing complete resolution of dissection and patency of the flow-diverter stent (white arrow).

as a priming protein for entry. This molecular cascade has been found in other organs systems, such as the brain, heart, and vasculature, through RNA sequencing and murine models.<sup>11,12</sup> The mechanisms of vascular damage and endothelial dysfunction may include the

direct invasion of endothelial cells by SARS-CoV-2 or the cytokine storm resulting from systemic inflammation.<sup>13</sup> An association between COVID-19 and spontaneous carotid artery dissection, however, has yet to be determined.

For stable patients with cerebral artery dissection, conservative therapy is often recommended as first-line therapy, often involving the use of antiplatelet therapy. This approach, however, is not based on data obtained in randomized clinical trials. For patients with persistent symptoms despite conservative therapy, surgical or endovascular treatment is reasonable. The use of flow-diverter stents has been well described for treating both cerebral aneurysms and carotid and vertebral artery dissection, as was used successfully in this case.<sup>14,15</sup> Patients with active or recent COVID-19 who present with persistent, unilateral head or neck pain with pulsatile tinnitus or bruit should be evaluated for potential cervical arterial dissection.

## Article Information

**Published:** 25 July 2024

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**Author Contributions:** All authors participated substantially in the conception and design of the work; or the acquisition, analysis, or interpretation of data for the work; drafting the work or revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

**Conflict of Interest Disclosure:** None.

**Funding/Support:** None.

**Acknowledgments:** Jaqueline Ferrufino and Carlo Uribe, MD, for image acquisition; Rebecca Bartow, PhD, for editorial assistance.

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