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Case Report

Fulminant simultaneous multiple dissections of the cervical and vertebral arteries leading to hemorrhagic and ischemic stroke: A case report

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ABSTRACT

Background: Intra-and extracranial artery dissections are uncommon but significant causes of ischemic stroke and subarachnoid hemorrhage (SAH). While individual dissections are well-documented, simultaneous dissections of multiple vessels leading to both hemorrhagic and ischemic strokes are extremely rare.

Case Description: A 41-year-old man presented with acute onset of headache, vomiting, and loss of consciousness. Imaging revealed multiple arterial dissections involving the bilateral internal carotid arteries and vertebral arteries (VAs). The patient was diagnosed with SAH caused by a ruptured fusiform aneurysm in the left VA. Emergency endovascular trapping was performed to treat the ruptured VA aneurysm. The following day, ischemic infarctions were observed in both hemispheres, prompting the initiation of dual antiplatelet therapy for the cervical carotid artery dissection. Despite the complexity of his condition, the patient achieved functional recovery, with a modified Rankin Scale score of 3 at discharge.

Conclusion: Simultaneous hemorrhagic and ischemic strokes due to multiple arterial dissections pose significant diagnostic and therapeutic challenges. This case highlights the importance of individualized treatment strategies and calls for further research to establish evidence-based guidelines for managing such complex conditions.

Keywords: Cerebral infarction, Internal trapping, Multiple dissection, Subarachnoid hemorrhage

INTRODUCTION

Intra- and extracranial artery dissections can sometimes lead to ischemic stroke or subarachnoid hemorrhage (SAH). Ischemic cases generally have a better prognosis than hemorrhagic ones and are typically treated with medication. In contrast, hemorrhagic cases tend to have a worse prognosis and often require surgical or endovascular intervention.[2,3] It is rare for both SAH and ischemic stroke to occur simultaneously.[4] Although multiple intra- and/or extracranial arterial dissections are relatively common, with an estimated prevalence of 20%, spontaneous dissection involving all four major vessels – bilateral internal carotid arteries (ICAs) and vertebral arteries (VAs) – is extremely rare.[5] We report a case of fulminant multiple dissections affecting both intra- and extracranial vessels, presenting with both hemorrhagic and ischemic strokes. This

case highlights the unique relationship between the affected vessels and stroke subtypes in multiple dissections.

CASE DESCRIPTION

Patient information

A 41-year-old man with no medical history, recent trauma, or family history of cerebrovascular disease, autoimmune disorders, or neurocutaneous syndromes was admitted to our hospital with a sudden onset of headache, vomiting, and loss of consciousness.

Clinical findings

The patient's level of consciousness was recorded as a Glasgow coma scale score of 7 (E2V1M4). On physical examination, no significant motor paralysis was observed. He had a National Institutes of Health Stroke Scale score of 26.

Diagnostic assessment

Computed tomography (CT) revealed diffuse SAH [Figure 1a]. CT angiography showed occlusion in the right ICA and aneurysmal changes in the bilateral intracranial VAs. Partial loss of contrast in the left ICA at the cervical level was also observed [Figure 1b]. Digital subtraction angiography (DSA) subsequently revealed a dissection in the cervical segment of the right ICA, accompanied by severe stenosis with a maximum luminal diameter of 0.72 mm, corresponding to an 84.4% stenosis based on the North American Symptomatic Carotid Endarterectomy Trial criteria. A left cervical ICA dissection was also confirmed, with poor contrast suggesting intramural thrombus formation. Fusiform aneurysms were identified in the bilateral intracranial VAs. The irregular shape of the aneurysm in the left VA, combined with the predominantly left sided localization of the hematoma, suggested aneurysmal rupture [Figures 1c-f]. The diagnosis was bilateral ICA dissections, right unruptured dissecting cerebral aneurysm, and left ruptured dissecting aneurysm.

Therapeutic intervention

To manage severe stenosis of the right ICA, fluid balance was carefully maintained to prevent collapse-induced occlusion. For the ruptured aneurysm in the left VA, which carried a high risk of fatal rebleeding, emergency endovascular internal trapping with coils was performed [Figures 2a and b]. The right VA aneurysm was suspected to remain unruptured. Given the risk of brainstem infarction from bilateral parent vessel occlusion, a decision was made to proceed with careful follow-up instead for the right VA. On the day following surgery, the patient remained unconscious after extubation, making neurological assessment challenging. Magnetic resonance imaging (MRI) was performed to evaluate for cerebral infarction due to severe stenosis of the right ICA. MRI revealed cerebral infarctions in both hemispheres [Figure 3a]. The extensive cerebral infarction in the left middle cerebral artery region was suspected to result from the progression of the left ICA dissection. DSA was performed to evaluate the necessity of carotid artery stenting. The right ICA did not change in shape, but the left ICA's intravascular thrombus had disappeared, and this was thought to be the cause of the cerebral infarction in the left hemisphere [Figure 3b]. As there was no progression of dissection and the thrombus had disappeared, it was judged that there would be no further progression of infarction and a stent was not implanted. Dual-antiplatelet therapy (DAPT) was initiated using aspirin (100 mg/day) and prasugrel (3.75 mg/day).

Follow-up and outcome

The patient showed no new symptoms during recovery. A follow-up DSA performed 22 days after the onset revealed significant morphological changes in the bilateral ICAs, while no notable changes were observed in the bilateral VAs [Figures 4a-d]. The patient was transferred to another hospital on day 42 with a modified Rankin Scale score of 3.

DISCUSSION

This case represents the first reported instance of simultaneous intracranial and extracranial dissections associated with both hemorrhagic and ischemic strokes, for which no established treatment guidelines currently exist. The underlying conditions in cases of multiple cerebral artery dissections often include connective tissue disorders and hereditary diseases, such as Ehlers-Danlos syndrome, osteogenesis imperfecta, Marfan syndrome, and other single-gene collagen-related disorders. These conditions are frequently observed in fulminant multiple dissections.[1,5] In addition, environmental factors such as cervical manipulation and a history of head-and-neck surgery have been suggested as potential triggers.[1] In such cases, the inherent weakness of blood vessels presents challenges for both surgical and endovascular treatments. In our case, standard tests and genetic testing conducted at a specialist hospital were unable to identify the cause.

For intracranial vertebral artery dissections that result in bleeding, internal trapping or surgical intervention is often performed to prevent re-rupture.[3] On the other hand, extracranial dissections are more likely to cause cerebral infarction, with artery-to-artery embolism being suggested as more common than hemodynamic mechanisms. Many cases also show improvement in vascular stenosis due to spontaneous morphological changes.[6,7] Reports suggest that, even in patients with highly fragile blood vessels,

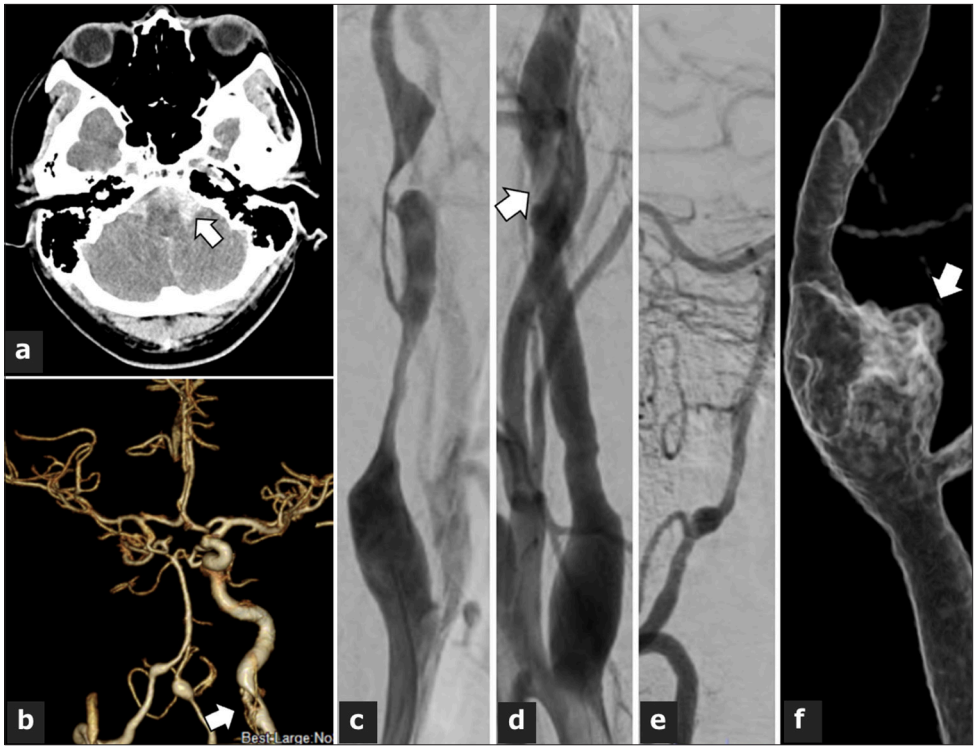

Figure 1: (a) Computed tomography showed a thick subarachnoid hemorrhage around the left vertebral artery (arrow). (b) Computed tomography angiography revealed dissections in the bilateral internal carotid arteries and vertebral arteries. The right internal carotid artery was occluded, while the left internal carotid artery showed a partial deficiency, likely due to a thrombus associated with dissection (arrow). Fusiform aneurysms were observed in both vertebral arteries. (c) Digital subtraction angiography demonstrated recanalization of the right internal carotid artery. (d) The left internal carotid artery had poor contrast (arrow). (e) The right vertebral artery displayed a fusiform aneurysm. (f) The left vertebral artery had a fusiform aneurysm with a bleb (arrow).

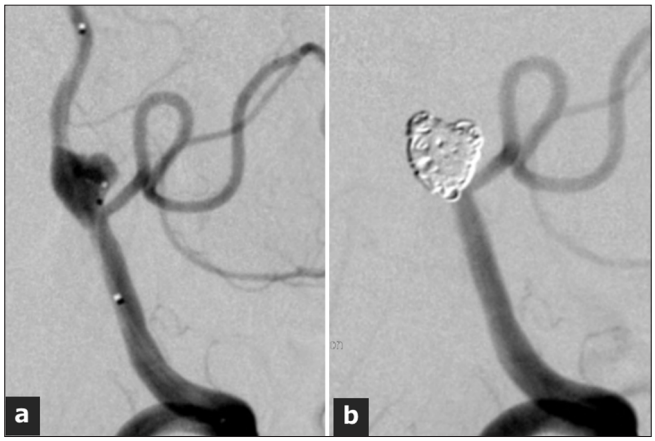

Figure 2: (a) Internal trapping of the left vertebral artery aneurysm was performed using double catheter technique. (b) The aneurysm was packed tightly with coils.

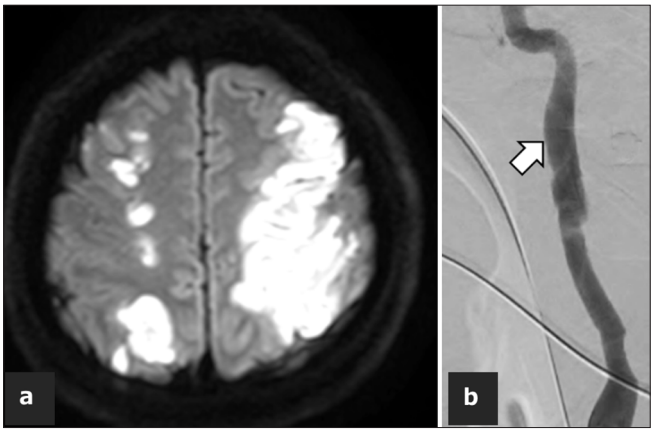

Figure 3: (a) Magnetic resonance imaging on the day after onset showed infarction in the right watershed region and left middle cerebral artery region. (b) Digital subtraction angiography showed the disappearance of a poorly contrasted area, which was suspected to represent a thrombus in the left internal carotid artery (arrow).

endovascular treatment can be performed safely by experienced specialists.[8] However,in general, it is recognized that there is a high risk associated with surgical intervention and endovascular treatment. Given the risk of serious complications associated with endovascular treatment,

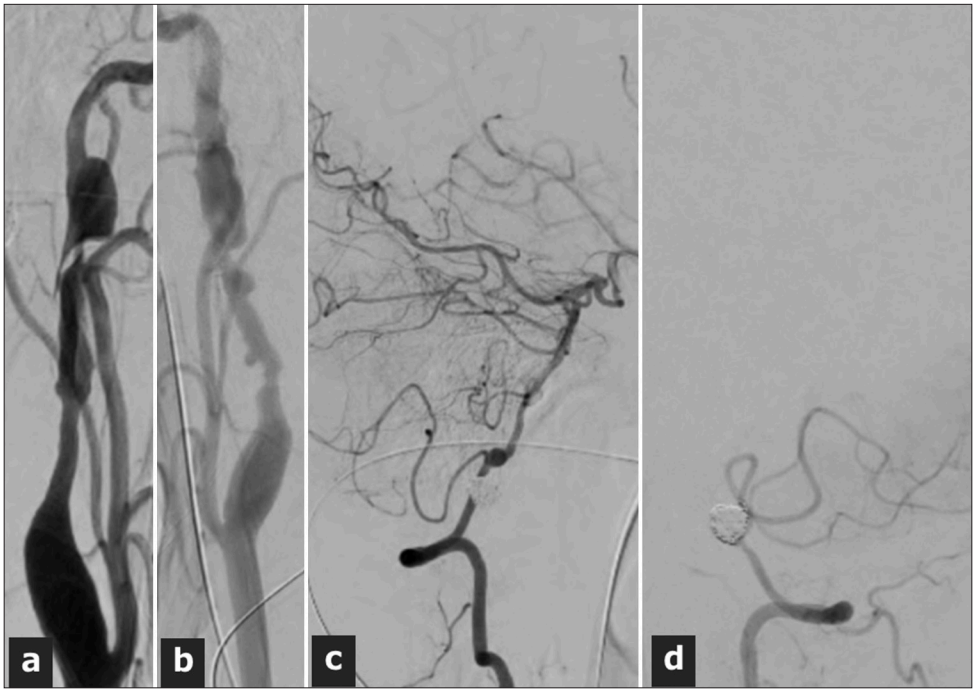

Figure 4: (a and b) A follow-up digital subtraction angiography performed 22 days after onset showed a significant morphological change in the bilateral internal carotid arteries. (c and d) The bilateral vertebral arteries remained stable.

drug therapy is often prioritized as the initial treatment for cerebral infarction caused by ICA dissection.[3,9] In addition, in general, dissection causes morphological changes, and there are many cases where it improves spontaneously without active intervention. For ruptured aneurysms that can be fatal, we performed endovascular treatment. For the severe stenosis of the right ICA, we judged that there was a tendency for improvement over time based on CT angiography and DSA, and as there was no severe stenosis on the left side either, we first managed fluid balance while taking into account the risks associated with stent placement. We started medical treatment DAPT the day after the surgery, but if we were to consider the possibility of artery-to-artery embolism, we think we should have started it on the day of the surgery. The choice between antiplatelet and anticoagulant drugs remains controversial, as anticoagulants may reduce the risk of cerebral infarction but increase the risk of bleeding.[10,11] In this case, an antiplatelet agent with a lower risk profile was selected due to the patient's history of SAH. The patient was relatively young, and rehabilitation led to functional improvement, achieving a modified Rankin Scale score of 3. However, if antiplatelet therapy had been initiated immediately after internal trapping, cerebral infarction might have been prevented, potentially leading to a better prognosis. Further studies are warranted to determine the optimal timing of antiplatelet therapy in similar cases.

CONCLUSION

There are currently no established treatment guidelines for cases in which hemorrhagic and ischemic strokes occur simultaneously due to multiple artery dissections. Medical treatment and surgical intervention should be carefully evaluated on a case-by-case basis. Further research is necessary to develop evidence-based guidelines for the management of such complex conditions.

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