Subarachnoid hemorrhage from a ruptured anterior cerebral artery aneurysm caused by polyarteritis nodosa

Case report

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Polyarteritis nodosa (PAN) is a rare systemic necrotizing vasculitis of small- and medium-sized arteries, and leads to infarcts, thrombus, and aneurysm formation in many organs. The most common sites affected in PAN are the skin, joints, kidneys, gastrointestinal tract, and peripheral nerves. Involvement of the CNS in PAN has also been reported, and the most common neurological finding is focal cerebral ischemia with stenosis or occlusion of intracranial arteries. Although aneurysm formation in visceral arteries is common in PAN, intracranial aneurysms are extremely rare, and only a few cases of aneurysm rupture associated with this disease have been documented. In this paper, the authors report on a ruptured PAN aneurysm of the anterior cerebral artery; the lesion was trapped and resected. On histological examination, extensive fibrinoid necrosis and an inflammatory infiltration of leukocytes were seen in the aneurysm wall. To the authors’ knowledge this is the first report of subarachnoid hemorrhage from a histologically confirmed PAN aneurysm.

KEY WORDS • polyarteritis nodosa • intracranial aneurysm • subarachnoid hemorrhage

Polyarteritis nodosa is a rare, systemic necrotizing vasculitis of small- and medium-sized arteries, and leads to infarcts, thrombus, and aneurysm formation in many organs. The most common sites affected in PAN are the skin, joints, kidneys, gastrointestinal tract, and peripheral nerves. Involvement of the CNS in PAN has also been reported, and the most common neurological finding is focal cerebral ischemia with stenosis or occlusion of intracranial arteries. Although aneurysm formation in visceral arteries is common in PAN, intracranial aneurysms are extremely rare, and only a few cases of aneurysm rupture have been documented. To our knowledge, no histopathologically verified case of ruptured, PAN-induced intracranial aneurysm has been reported. We report a case of ruptured PAN aneurysm that was resected and histopathologically examined. The unusual postoperative course is also described.

Case Report

History and Examination. This 70-year-old woman presented with transient loss of consciousness, and was referred to our clinic 3 days after the attack. She had suffered from renal dysfunction, purpura, multiple ulcers in her legs, and general malaise, and a skin biopsy performed 1 year earlier led to a diagnosis of leukocytoclastic vasculitis in small vessels. With these findings and positive serum p-ANCA, she was diagnosed as having PAN and had been taking prednisolone for more than 1 year. On admission, she reported continuous severe headache but had no neurological deficit. A head CT scan revealed SAH in the basal cistern (Fig. 1A). Results of digital subtraction angiography and three-dimensional digital angiography demonstrated an aneurysm on the left ACA (Fig. 1B and C).

Operation. The patient underwent an emergency craniotomy following the angiographic study. The aneurysm was exposed via the left pterional approach, and it became clear that the A1 portion of the left ACA was involved in the aneurysm. There was a dense clot around the aneurysm dome, indicating that the lesion had ruptured. The ACA was clipped at the proximal and distal side of the lesion, then the aneurysm was resected.

Histopathological Examination. Remarkable fibrinoid necrosis was found in the aneurysm wall, and the normal structure was completely destroyed (Fig. 2). Extensive inflammatory infiltration of polymorphonuclear leukocytes and eosinophils was seen. These findings were compatible with necrotizing arteritis of PAN. Fresh hematomas were found in the adventitial and subadventitial layers, which proved rupture of the aneurysm.

Postoperative Course. No neurological deficit was found on postoperative Day 1, and prednisolone therapy was resumed. Because the patient became restless and aphasic on Day 2 (5 days after the initial attack), cerebral angiography was performed (Fig. 3). The left A1 was occluded by clips, with sufficient collateral flow from the right A1 to the left A1 through the anterior communicating artery. Vasospasm was found in the left middle cerebral artery. Hypervolemic therapy was started to prevent deterioration of the symptomatic vasospasm, resulting in some improvement of her neurological status.

Abbreviations used in this paper: ACA = anterior cerebral artery; CNS = central nervous system; c-PAN = classic polyarteritis nodosa; CT = computerized tomography; MPA = microscopic polyangiitis; p-ANCA = perinuclear antineutrophil cytoplasmic antibodies; SAH = subarachnoid hemorrhage.
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symptoms on the next day. On Day 9, she developed severe pneumonia and the blood platelet count decreased, indicating the onset of consumption coagulopathy. On Day 10, she became comatose and a CT scan revealed massive hemorrhage in the left temporooccipital region (Fig. 4). After emergency evacuation of the hematoma, her consciousness level gradually improved, but right hemiplegia and global aphasia persisted. Serum levels of p-ANCA in the chronic state were still positive (190 enzyme-linked immunosorbent assay units; normal range < 10).

Discussion

A rare systemic autoimmune disease, PAN is characterized by necrotizing arteritis of various organs. This patient fulfilled the diagnostic criteria of the American College of Rheumatology before the intracranial event occurred, with skin purpura, renal dysfunction, and histological findings of necrotizing arteritis in the biopsy sample of skin. Recently, PAN was subdivided into c-PAN and MPA. The c-PAN manifestation usually involves medium- and small-sized arteries, and the typical clinical presentation consists of nonspecific symptoms (for example, fever and weight loss) and inflammatory or ischemic findings in the skin, joints, kidneys, gastrointestinal tract, and peripheral nerves. The affected vessels display stenosis and aneurysm formation. On the other hand, MPA is a clinical entity reported as a subgroup of PAN. It affects small-sized vessels (that is, capillaries, venules, or arterioles) without abnormal angiographic findings, and it is usually associated with rapidly progressive glomerulonephritis. Although it is rare (< 20%) in c-PAN, p-ANCA, an autoantibody to the cytoplasm of neutrophils, is positive in 50 to 80% of patients with MPA. Even though c-PAN and MPA were recently recognized as different diseases, capillary involvement or antineutrophil cytoplasmic antibody positivity, which are typical features of MPA, are reported even in c-PAN. This indicates that overlapping disorders exist and that it is not always easy to distinguish between c-PAN and MPA. We suspect overlap in our case because there was aneurysm formation (suggestive of c-PAN) and positive p-ANCA (suggestive of MPA).

To our knowledge, this is the first report of a ruptured intracranial PAN aneurysm accompanied by histological evidence. Although CNS complications in PAN are not rare, the most common finding is focal ischemic lesions caused by stenosis or occlusion of intracranial arteries. Intracerebral hemorrhage and SAH from the affected vessels have

Fig. 1. Admission neuroradiological studies. A: Axial CT scan demonstrating SAH in the basal cistern. B and C: Results of digital subtraction angiographic study and three-dimensional digital angiographic study, respectively, revealing an aneurysm on the left ACA.

Fig. 2. Photomicrographs of the resected aneurysm showing necrotizing arteritis. A and B: Serial sections of the aneurysm dome showing that the normal structure of the aneurysm wall is destroyed. Fresh hematomas are found in the adventitial and subadventitial layers (A, arrows), which prove rupture of the aneurysm. Internal and external elastic laminae have completely disappeared (B). H & E (A) and Elastica van Gieson staining (B), original magnification × 5. C: An extensive inflammatory infiltration of leukocytes (arrowheads) and fibrinoid necrosis (asterisk) are detected. H & E, original magnification × 40. D: Deposition of fibrinoid materials is recognized in the necrotic area (arrows). Phosphotungstic acid hematoxylin stain, original magnification × 40.
also been documented.\textsuperscript{2,5} Aneurysms, however, which are common findings of c-PAN in visceral arteries, are extremely rare in the intracranial circulation, and only a few cases have been reported.\textsuperscript{10,13,14} Furthermore, there has been no report of SAH from cerebral PAN aneurysms that were confirmed histopathologically. Fatal SAH from a posterior cerebral artery aneurysm in a patient with PAN was reported in 1950,\textsuperscript{16} but it is unclear whether the aneurysm was related to the arteritis. A case of SAH from a dissecting vertebral artery aneurysm has also been reported,\textsuperscript{4} but it is again unknown whether the lesion originated from PAN. In our case, histopathological examination proved that the ACA aneurysm had been formed by necrotizing arteritis, and that it had ruptured.

The postoperative clinical course of the patient was unusual. Massive intracerebral hemorrhage occurred on postoperative Day 10. Because cerebral angiography on Day 2 had demonstrated no abnormality besides vasospasm, it is hard to conceive that bleeding occurred from another arterial lesion caused by the vasculitis. Cardiogenic embolism has been reported as the cause of cerebral infarction in PAN,\textsuperscript{13} but echocardiography could detect no intracardiac thrombi. Therefore, it was suspected that consumption coagulopathy may have precipitated hemorrhagic transformation of the cerebral infarction caused by vasospasm.

Intracranial aneurysm formation is a rare CNS manifestation of PAN; however, in this case we documented the possibility of its rupture and life-threatening SAH. Early detection and appropriate treatment are recommended.

References


Fig. 3. Bilateral internal carotid arteriograms obtained on postoperative Day 2. A: Collateral blood supply from the right A 1 to the left A 1 through the anterior communicating artery is preserved. B: The left A 1 is occluded by clips. Vasospasm is seen in the left middle cerebral artery (arrow).

Fig. 4. Axial CT scan obtained on postoperative Day 10, revealing a massive hemorrhage in the left temporoooccipital region.