

Surgical Treatment of Internal Carotid Artery Anterior Wall Aneurysm with Extravasation During Angiography

—Case Report—

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Abstract

A 54-year-old female presented subarachnoid hemorrhage from an aneurysm arising from the anterior (dorsal) wall of the internal carotid artery (ICA). During four-vessel angiography, an extravasated saccular pooling of contrast medium emerged in the suprasellar area unrelated to any arterial branch. The saccular pooling was visualized in the arterial phase and cleared in the venophase during every contrast medium injection. We suspected that the extravasated pooling was surrounded by hard clot but communicated with the artery. Direct surgery was performed but major premature bleeding occurred during the microsurgical procedure. After temporary clipping, an opening of the anterior (dorsal) wall of the ICA was found without apparent aneurysm wall. The vessel wall was sutured with nylon thread. The total occlusion time of the ICA was about 50 minutes. Follow-up angiography demonstrated good patency of the ICA. About 2 years after the operation, the patient was able to walk with a stick and to communicate freely through speech, although left hemiparesis and left homonymous hemianopsia persisted. The outcome suggests our treatment strategy was not optimal, but suture of the ICA wall is one of the therapeutic choices when premature rupture occurs in the operation.

Key words: internal carotid artery, subarachnoid hemorrhage, dorsal wall aneurysm, superior wall aneurysm, pseudoaneurysm

Introduction

Aneurysms arising from the anterior wall of the internal carotid artery (ICA) have been described as blister-like aneurysm, dorsal ICA aneurysm,⁹⁾ superior wall of ICA aneurysm,⁴⁾ and distal medial wall aneurysm.¹⁶⁾ Such aneurysms are located on C₁ or C₂ segment of the ICA projecting anteromedially and are unrelated to arterial bifurcation. The aneurysm wall is extremely thin and fragile with a marked tendency to rupture during surgical treatment.^{9,17)} Such aneurysms may be caused by dissection of the arterial wall.^{11,14)}

We present a case of ICA anterior wall aneurysm associated with extravasation during emergency angiography. The extravasation did not extend freely to the subarachnoid space, but was confined to a

small area close to the rupture site surrounded by a blood clot barrier.

Case Report

A 54-year-old female presented with sudden onset of severe headache and consciousness disturbance. She was transferred to our medical center by ambulance. On admission, she was stuporous with Hunt and Kosnik grade 4. Her pupils were isocoric and light reflex was normal. Computed tomography (CT) showed diffuse subarachnoid hemorrhage, part of which appeared as a round and slightly higher density area in the right suprasellar cistern, suggestive of a thrombosed aneurysm (Fig. 1). However, cerebral angiography failed to demonstrate any abnormal findings in the initial four-vessel study. About one hour after beginning the examination, saccular pooling of contrast medium was found in the supraclinoid area, which appeared in the arterial



Fig. 1 Computed tomography scan on admission, showing diffuse subarachnoid hemorrhage including a round, relatively high density area (arrowhead) in the right suprasellar cistern indicating a localized tough clot.

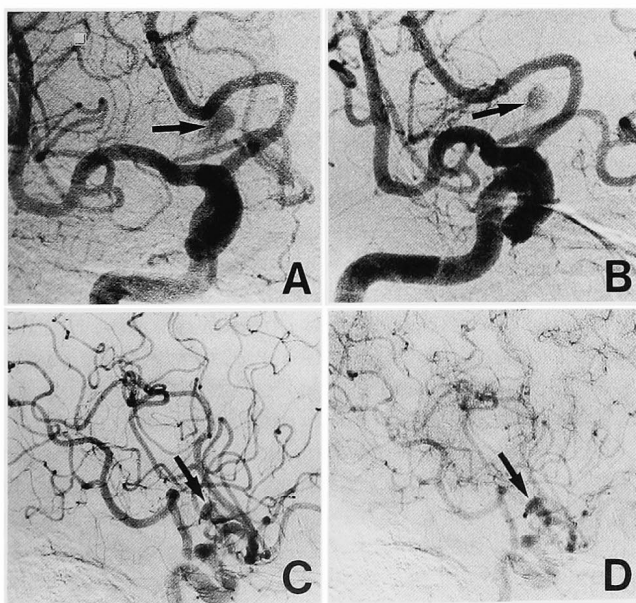


Fig. 2 Right internal carotid angiograms, left anterior oblique (A), right anterior oblique (B), and lateral views (in the mid-arterial phase [C] and late-arterial phase [D]), revealing a round saccular pooling of extravasated contrast medium (arrow).

phase and disappeared in the late venous phase (Fig. 2). As both visualization and clearance of the pooling were observed with every contrast medium injection, we suspected that the pooling communicated with an artery. The location of the pooling was remote from the main branches of the ICA, so we suspected a large saccular aneurysm distended rapidly with a very thin wall, or extravasation surrounded by hard clot. The neck and site of origin of the aneurysm were unclear. We tentatively diagnosed a partially thrombosed aneurysm with extravasation rather than a typical saccular aneurysm based on the CT and angiographical findings.

The patient underwent emergency operation on the same day. The right ICA was exposed through a pterional approach. The dorsomedial wall of the ICA (cisternal segment) was covered with a tough and thick clot. After exposing the proximal control site, we approached the aneurysmal neck. Massive arterial bleeding occurred during dissection of the clot. Three temporary clips were applied to the distal and proximal ICA, and the posterior communicating artery. After the bleeding was controlled, we found an opening of the anterior wall on the ICA but no apparent aneurysmal sac. The site corresponding to the aneurysmal dome was hard and consisted of thick clot. Although some clips were applied parallel to the ICA, effective clipping was impossible. We decided to repair the wall with interrupted 8-0 nylon microsutures. After removal of the temporary clips, oxycellulose and fibrin glue were placed on the minor leakage site of the sutures. Total occlusion time of the ICA was about 50 minutes. Barbiturate was administered for brain protection. Histological examination of the clot specimen obtained during the operation showed simple blood clot with fibrin, indicating that the wall of the aneurysm or extravasation cavity consisted of hematoma without materials derived from the true arterial wall.

Cerebral angiography on the next day revealed a mildly stenotic but patent right ICA supplying adequate blood flow for the right cerebral hemisphere (Fig. 3). Her blood pressure was kept under 120 mmHg, and the barbiturate coma was maintained for another 72 hours. She was comatose for one week, after which her consciousness level improved gradually but left hemiparesis and left homonymous hemianopsia were present. Postoperative CT demonstrated a diffuse low density area in the right cerebral hemisphere, which decreased in size in the subacute period, and the true infarct area was smaller than expected (Fig. 4). Follow-up angiography was performed on the 9th and 28th days after the operation. The stenosis of the repaired ICA

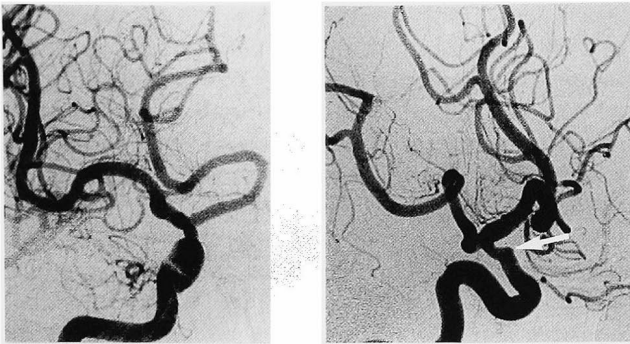


Fig. 3 Right internal carotid angiograms, anteroposterior (left) and lateral (right) views, after repair of the right internal carotid artery, showing the slightly stenotic sutured portion on the anterior wall (arrow), with good patency of the artery.

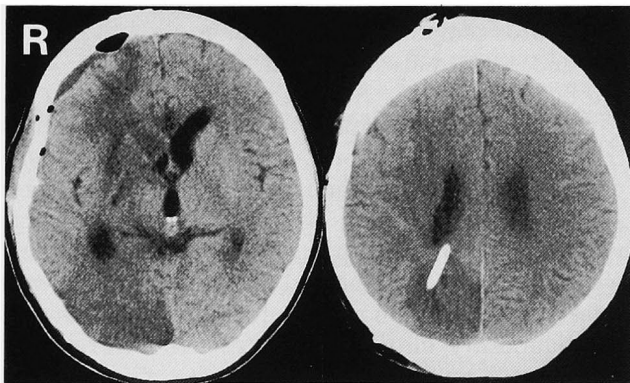


Fig. 4 Computed tomography scans about one month after operation, demonstrating low density areas located in the right occipital, frontal, and basal ganglia. The cerebral cortex supplied by the middle and anterior cerebral arteries is relatively preserved from ischemia. The patient underwent cranioplasty and ventriculoperitoneal shunt.

showed improvement with no aneurysmal dilatation in the region of the suture.

The patient underwent cranioplasty and ventriculoperitoneal shunt placement one month after the operation. She made a dramatic recovery. Forty days after surgery, she was alert and able to stand with assistance. She was transferred to a rehabilitation facility for further physiotherapy. Recently, about 2 years after the operation, we obtained detailed follow-up data from the referring physician by telephone. The patient was able to walk with a stick and to communicate freely through

speech, although the left hemiparesis and left homonymous hemianopsia persisted.

Discussion

The operative findings of our case were an opening corresponding to the neck of a true aneurysm located on the dorsomedial wall of the cisternal segment (C₂) at a nonbranching site of the ICA, which was confirmed by follow-up angiography. We suspect that formation of the blister-like aneurysm or dissecting aneurysm preceded extravasation during the angiography. Angiography failed to detect any aneurysm at the beginning of the examination, possibly because the aneurysm was too small to detect at the initial angiography, or as no clear aneurysmal wall or dome was found near the neck in the operative exploration, the aneurysm wall was so thin that ordinary spontaneous obliteration of the rupture site had not occurred at the initial bleeding. Extravasated blood had formed a firm and thick clot mass compressing the rupture site from the outside, thereby achieving primary hemostasis. The aneurysm ruptured again during the angiography, resulting in formation of the extravasation cavity which communicated with the parent artery and the surrounding clot at this time. A previous case of blister-like aneurysm at the superior wall of the ICA also showed no definite aneurysm on angiography.⁴⁾ At operation, the ICA was covered with a tough and fibrous clot, and when this clot was removed, massive arterial bleeding occurred. Autopsy found disappearance of the internal elastic lamina and media near the rupture point, which was covered with normal adventitia and fibrous tissue. This previous case is similar to ours before extravasation during angiography. Arterial dissection may cause rupture of the arterial wall without development of a saccular aneurysm.¹¹⁾ Therefore, dissection may have developed at the initial rupture in our case.

The wall of the extravasation cavity must consist of hard hematoma. Although the medical term of pseudoaneurysm or false aneurysm is not clearly defined in textbooks of neurosurgery, our case would be included in the definition of a saccular cavity which is totally or partially surrounded by materials not derived from the true arterial wall. However, the extravasation cavity derived from major rupture of a true aneurysm is not called a pseudoaneurysm. The surgical specimen in our case corresponding to the aneurysmal dome was revealed to be only a clot but the parent vessel was not examined. Therefore, the pathological diagnosis of pseudoaneurysm is impossible to be established. Pseudoaneurysm may be caused by trauma,^{7,8,12)} iatro-

genic procedures,¹⁵⁾ ruptured arteriovenous malformation,²⁾ and moyamoya disease.¹⁷⁾ Bleeding from the parent vessel obviously occurs at the initial stage regardless of the etiology. Recently, pseudoaneurysm after rupture of dissecting aneurysm has been reported in autopsy cases.^{1,13)} We think that the definition of pseudoaneurysm is still unclear.

The laceration of the arterial wall was repaired with nylon thread. During the repair three clips were needed including one on the posterior communicating artery, which reduced cerebral blood flow in the territories of both the middle cerebral artery and the posterior cerebral artery for 50 minutes. A distal medial wall ICA aneurysm ruptured at its base was repaired by microsutures of the carotid artery with temporary clips applied to the ICA just distal to the origin of the posterior communicating artery and just proximal to the origin of the anterior choroidal artery. If the aneurysm had been located distally 1 cm away from the origin of the posterior communicating artery, we would have adopted this technique. The suture method is not always successful. We succeeded because arteriosclerotic change of the vascular wall was mild, the elastic lamina was preserved, and the hole faced the surgeon. Failure to repair the wall would have required trapping of the ICA with external and internal carotid bypass or a wrapping clip with Hemashield¹⁰⁾ or silastic sheet.⁵⁾

About 2 years after operation, the patient's left hemiparesis and homonymous hemianopsia persist. CT showed infarct areas in the right cerebral hemisphere. The outcome suggests that our strategy for the treatment might not have been optimal. We could have chosen other methods for treatment. If the fetal type of the posterior communicating artery had branched distal from the aneurysm, the ICA could have been trapped between the proximal and distal ends of the aneurysm. However, since the posterior communicating artery branched near the aneurysm, this method was impossible to perform. Most such cases have been successfully treated with an endovascular approach^{3,6,8,15)} using balloons, coils, or liquid adhesives such as N-butylcyanoacrylate. However, aneurysms with extravasation are liable to rebleed during endovascular procedures. Embolization may be hazardous. Placement of a high flow radial artery graft and trapping of the ICA is another method, premature rupture is very likely to occur during the exposure of the ICA even in the case of trapping, making temporary clipping inevitable. Thus, the occlusion time until bypass flow is established is the same as that for suturing of the wall. We think that trapping and anastomosis have the advantage of maintenance of

cerebral blood flow if the graft is placed before exposure and trapping of the ICA. When premature rupture occurs, suture of the ICA wall is another choice. It is important to realize that the treatment of aneurysms with angiographical findings similar to the present case is not so easy, so several strategies based on different methods or instruments must be prepared prior to premature rupture.

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