

# Middle Cerebral Artery Thrombolysis Through the Contralateral Internal Carotid Artery

## —Case Report—

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### Abstract

A 63-year-old male presented with sudden onset of right hemiplegia and global aphasia. On admission he was stuporous. Computed tomography (CT) revealed no abnormalities except for right intraventricular meningioma found incidentally. Emergency angiography confirmed complete occlusion of the left internal carotid artery (ICA) and left M<sub>1</sub> trunk whereas the left ICA bifurcation remained patent. The ipsilateral ICA was permanently occluded with two detachable balloons to prevent thrombus migration into the distal ICA and middle cerebral artery (MCA), followed by thrombolysis of the clot in the ipsilateral M<sub>1</sub> through the contralateral ICA with urokinase (total dose 420,000 U) under systemic heparinization. Partial recanalization of the ipsilateral MCA was accomplished. The time interval from onset to recanalization was about 3 hours. Postoperative CT showed no hemorrhagic transformation. Slight right paresis and mild motor aphasia persisted 2 months later and he was transferred to a rehabilitation facility. Thrombolysis of the MCA embolism can be performed through the contralateral ICA in the presence of ipsilateral ICA occlusion.

Key words: internal carotid artery occlusion, middle cerebral artery thrombolysis, contralateral internal carotid artery

### Introduction

The prognosis for patients with acute cerebral embolism in the internal carotid artery (ICA) is miserable. Angiographical ICA occlusion is considered impossible to treat successfully in most cases because of the high rate of complications such as hemorrhagic transformation or difficulty of restoration of the blood flow.<sup>5,7,9,11</sup> Rapid disruption or dissolution of the thrombus in the ICA is very difficult. We treated a patient admitted with acute profound stroke, caused by permanent ipsilateral ICA occlusion, by intracranial arterial thrombolysis in the ipsilateral middle cerebral artery (MCA) using a catheter passed through the contralateral ICA.

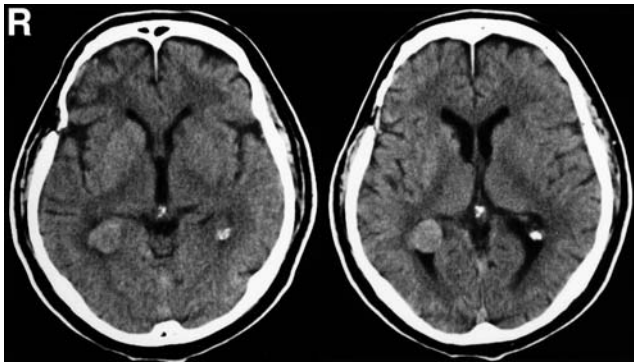
### Case Report

A 63-year-old, right-handed man presented to our emergency room 30 minutes after the onset of stroke. He was stuporous with right face, arm, and

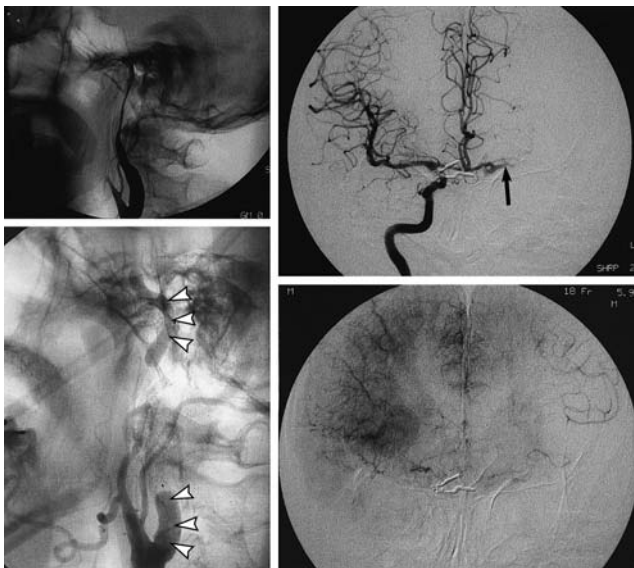
leg hemiplegia and global aphasia. His medical history showed hypertension and diabetes mellitus, and coronary artery bypass grafting for acute myocardial infarction 10 years before and surgical clipping for ruptured aneurysm of the anterior communicating artery (AcomA) one year later.

Computed tomography (CT) on admission demonstrated no clear evidence of hemorrhage or infarction, but detected an intraventricular meningioma incidentally (Fig. 1). Left common carotid artery angiography demonstrated total occlusion of the left ICA from the cervical portion to the carotid siphon (Fig. 2). Right ICA angiography showed occlusion at the horizontal portion of the left MCA and good collateral flow for the territory through the leptomeningeal anastomosis without occlusion of the left ICA bifurcation. The orifice of the posterior communicating artery was presumably occluded by the thrombus, so vertebral angiography was not performed.

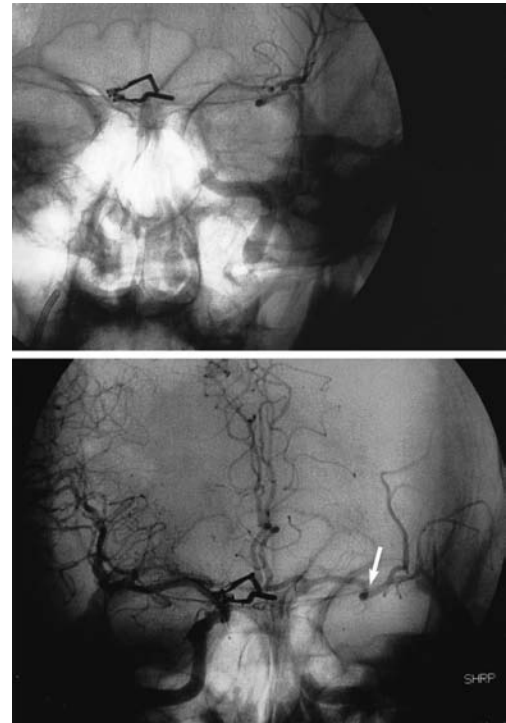
We considered that microcatheter navigation through the AcomA was feasible and avoidance of future embolic events in the ICA to MCA was



**Fig. 1** Initial computed tomography scans showing no abnormality such as sulcal effacement, mass effect, edema, or possible hemorrhage.



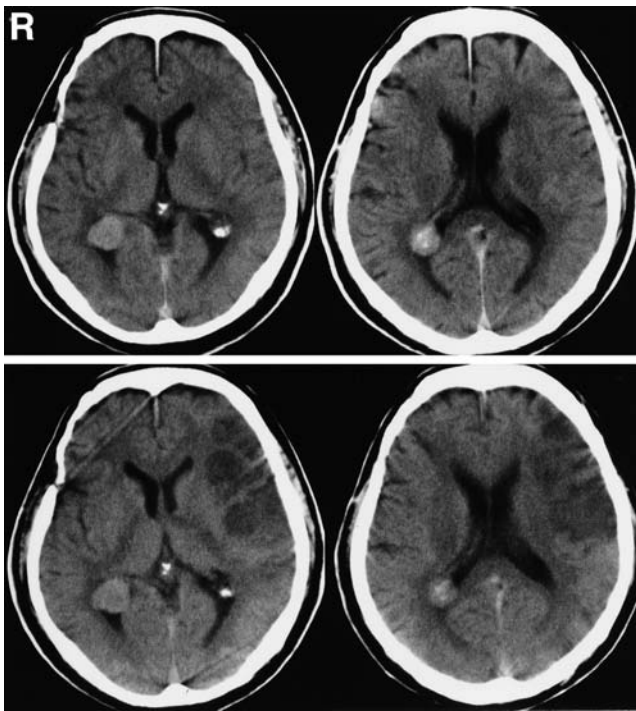
**Fig. 2** Emergency angiogram revealing thrombus in the left internal carotid artery (ICA) and complete extracranial occlusion (upper left). Anteroposterior digital subtraction angiograms of the right ICA showing the ICA terminal segment and M<sub>1</sub> segment of the left middle cerebral artery filling across the anterior communicating artery and then abruptly stopping (arrow) (upper right), and the relatively good leptomeningeal collaterals (lower right). The left ICA was treated with permanent balloon occlusion to minimize the risk of recanalization and possible future embolic events (arrowheads) (lower left).



**Fig. 3** Superselctive angiogram of the left M<sub>1</sub> segment during thrombolysis through the contralateral internal carotid artery (ICA) and anterior communicating artery (AcomA) showing the microcatheter was positioned in the left M<sub>1</sub> segment across the AcomA (upper). Anteroposterior digital subtraction angiogram of the right ICA after thrombolysis revealing recanalization of posterior branch of the left middle cerebral artery with residual thrombus (arrow), which was not treated (lower).

essential. Therefore, permanent left ICA occlusion with detachable balloons (Gold valve balloons 9 and 16; MinVasys, Paris, France) was performed (Fig. 2), followed by thrombolysis of the thrombus in the left MCA through the contralateral ICA and AcomA to shorten the operation time and to prevent thrombus migration to the distal ICA and MCA under systemic heparinization (5000 U heparin bolus, and then 1000 U/hr) (Fig. 3). The urokinase was infused from distal site of the occluded segment. The catheter (TRACKER-10; Boston Scientific, Natick, Mass., U.S.A.) and the guidewire (GT wire; Terumo, Tokyo) were also used to mechanically push through the clot. Partial recanalization of MCA was finally achieved 200 minutes after onset by administration of 420,000 U of urokinase, but the clot in the superior trunk could not be dissolved (Fig. 3).

At this stage, 2 hours had elapsed from the



**Fig. 4** Computed tomography scans obtained just after the treatment (upper row) and the day after the procedure (lower row) showing the development of anterior left middle cerebral artery infarction, but no hemorrhagic transformation.

beginning of the thrombolysis. Therefore, we abandoned further thrombolysis for fear of hemorrhagic complication.

His neurological symptom was improved gradually after the procedure and CT showed no hemorrhagic transformation (Fig. 4). Ischemic change in the left frontal region was shown by CT the day after the procedure (Fig. 4), but no complications such as hemorrhagic infarction or cerebral edema were detected in the postoperative course. He had slight right paresis and mild motor aphasia 2 months after the procedure, and he was transferred to a rehabilitation facility. Cerebral blood flow study demonstrated no differences between the bilateral hemispheres except for the left frontal lesion.

## Discussion

Thrombolysis has become commonly used for the treatment of cerebral embolism. In particular, local intraarterial thrombolysis of MCA occlusion may benefit patients with evolving thromboembolic stroke.<sup>5,7,9,11-14</sup> The validity of local intraarterial thrombolysis for MCA occlusion has been estab-

lished by a controlled clinical trial,<sup>4</sup> but the prognosis for patients with profound neurological deficits and acute ICA occlusion remains dismal.<sup>5,7,11</sup> Therefore, the operative indication of ICA thrombolysis is limited.<sup>11</sup> The intraarterial microcatheter technique can deliver highly concentrated drug and allows mechanical disruption from proximal site of the clot, but the procedure is not always successful because of the time required if the clot is large, and the clot may migrate to the distal ICA or MCA. However, conservative treatment leads to tragic outcomes in most cases,<sup>9</sup> so thrombolysis is still the optimum treatment.

Recently, the catheter has been passed through the ipsilateral ICA in cases of MCA thrombolysis with cervical ICA occlusion. The microcatheter was navigated through the occluded segment up to the supraclinoid ICA or MCA in four patients with good collateral flow.<sup>9</sup> MCA thrombolysis was successful after coil embolization of the ipsilateral cervical ICA. Eight cases of extracranial ICA occlusion with MCA embolism were treated through the collapsed lumen of the ICA with good outcomes in half of the cases.<sup>3</sup> ICA occlusion with MCA embolism had higher recanalization rates and better outcomes than carotid T occlusion, or embolism of the intracranial ICA bifurcation, suggesting that the type of occlusion and time for recanalization affected the outcome. Local intraarterial thrombolysis has achieved excellent outcomes in cases of extracranial ICA occlusion,<sup>5,7,9,14</sup> but is less efficacious in cases of carotid T occlusion.<sup>5-8,11,14</sup> Five of 12 patients with carotid T occlusion died, indicating that a good clinical outcome is the exception.

Thrombolysis was started within 170 minutes of the onset of symptoms in the excellent clinical outcome group.<sup>14</sup> The time elapsed from onset to treatment as well as good collateral flow are important to attain successful thrombolysis.<sup>14</sup> Successful treatment leading to good prognosis in cases of MCA embolism with ICA occlusion is possible if there is excellent collateral flow, except in the presence of carotid T occlusion. "Excellent or good collateral flow" is defined as retrograde filling of the MCA territory within 5 seconds of the end of intracarotid injection.<sup>14</sup> Good collateralization is also important.<sup>1,2,8,10</sup> Initial assessment of the collateral flow from the contralateral ICA and vertebralbasilar system is essential for determining the amount of thrombus. If the flow from the A<sub>1</sub>-AcomA or posterior communicating artery is adequate, then treatment of the MCA, the distal ICA, and the A<sub>1</sub> segment may be all that is necessary.<sup>9</sup>

In the present case, the procedure was commenced at the early stage, the collateral circulation

was good, which enabled the left ICA to be occluded mechanically, and no carotid T occlusion was present. The thrombolysis was concentrated on the clots in the ipsilateral MCA, and the left ICA was permanently occluded by balloon to minimize the risk of recanalization causing possible future embolic events and to shorten the time required because of the amount and extent of thrombus. As a result, partial recanalization of MCA was achieved in a short time of about 3 hours. We considered that these factors led to the good outcome in the present case.

Thrombolysis in the MCA with an ipsilateral occluded ICA may be approached through the ipsilateral occluded proximal ICA or through the contralateral ICA. The risk of perforation in a normal cervical or petrous carotid artery may be lower than the risk of intracranial vascular perforation, at about 1.25%, but further study is needed to define which approach is safer.<sup>9)</sup> The current approach as well as the approach through the occluded carotid artery can be considered to treat the clot more rapidly, to prevent clot migration, and to accomplish a better outcome. Our approach through the contralateral ICA may be an effective method of thrombolysis to reduce the damage of ischemia in a patient with good collateral flow.

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