



Mechanical Thrombectomy for Acute Middle Cerebral Artery Occlusion Caused by Tumor Embolism: A Case Report

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Objective: We report a case of acute middle cerebral artery (MCA) occlusion caused by tumor embolism.

Case Presentation: A 64-year-old man with lung cancer presented with sudden onset left-sided hemiparesis and sensory disturbance. Diffusion-weighted imaging (DWI) revealed hyper-intense foci in the right MCA territory and magnetic resonance angiography (MRA) demonstrated right MCA M2 segment occlusion. Mechanical thrombectomy (MT) was performed with Thrombolysis in Cerebral Infarction 2B recanalization. On histopathology, thrombus composed of fibrin and squamous cell carcinoma was observed. We diagnosed him with tumor embolism from lung cancer that invaded the pulmonary vein and the left atrium.

Conclusion: Tumor cells may be confirmed by pathological examination regardless of the morphology of the embolus. Pathological examination of the cerebral embolus is useful for the accurate diagnosis of ischemic stroke subtypes.

Keywords ► tumor embolism, stroke, thrombo-pathology, mechanical thrombectomy, lung cancer

Introduction

For acute ischemic stroke, mechanical thrombectomy (MT) is established as an effective treatment and is widely performed. The recanalization rate has been improved with the development of devices, and it has become possible to assess the cause of stroke by pathological examination of retrieved thrombi. In the case reported here, we diagnosed tumor embolism by pathological examination of the thrombus. As there are few reports of detection of tumor cells by

pathological examination, the case is reported with a review of the literature.

Case Presentation

The patient was a 64-year-old man who suddenly developed left-sided hemiparesis and sensory disturbance. He underwent brain magnetic resonance imaging (MRI) at another hospital and was diagnosed with acute cerebral infarction. The patient arrived at our hospital 208 minutes after onset. He was diagnosed with squamous cell carcinoma of the lung (cT4N3M0 Stage IIIB) 1 year previously and underwent chemoradiotherapy. He had a history of paroxysmal atrial fibrillation and lacunar infarction. He complained of strong malaise for 1 month and was hospitalized at another hospital. He had small-volume hemoptysis during hospitalization. On arrival at our hospital, he had left-sided facial palsy, hemiparesis and severe sensory disturbance, mild dysarthria, and left hemispatial neglect. National Institutes of Health Stroke Scale score was 10. MRI demonstrated hyper intensities from the right insular cortex to the right parietal lobe on diffusion-weighted imaging (DWI) (**Fig. 1A**). The DWI-Alberta Stroke Program Early CT Score was 8. On magnetic resonance angiography (MRA), the M2 segment of the right middle cerebral artery (MCA) was occluded (**Fig. 1B**). As intravenous thrombolysis with

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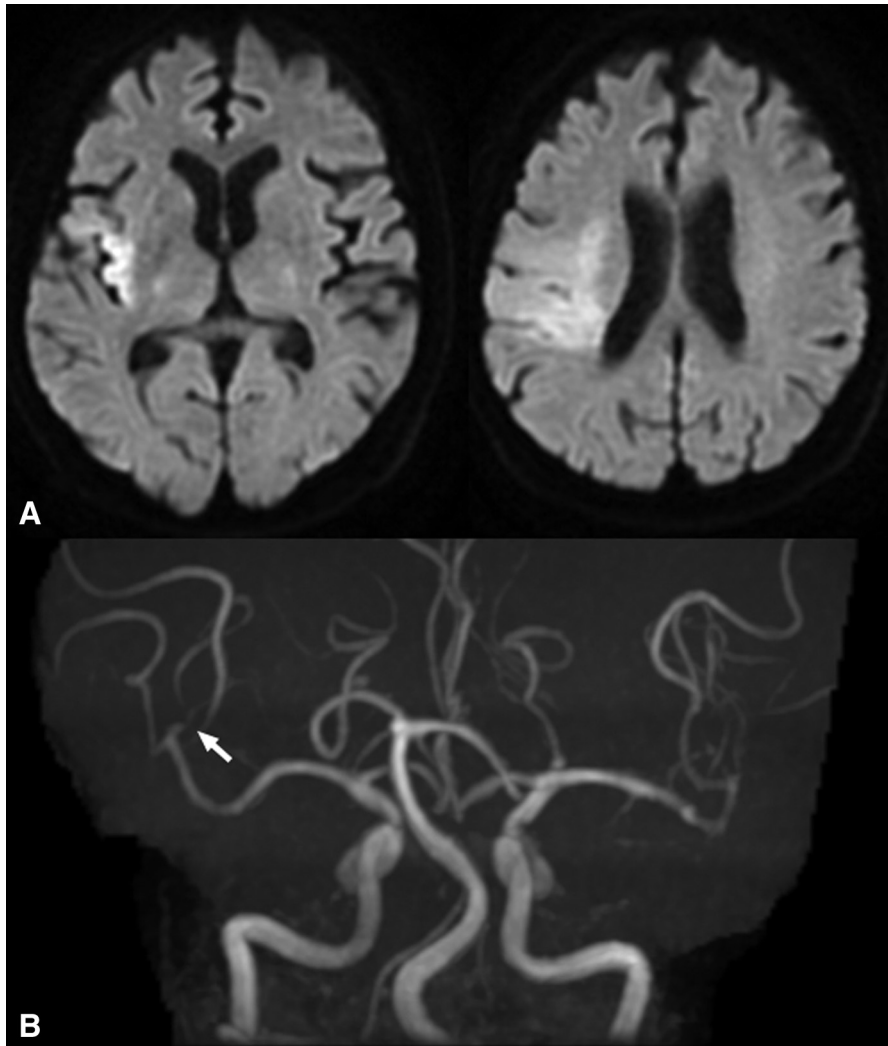


Fig. 1 (A) Axial diffusion-weighted images show acute ischemic lesion in the right MCA territory. (B) MRA shows right MCA M2 segment occlusion. (white arrow). MCA: middle cerebral artery; MRA: magnetic resonance angiography

recombinant tissue plasminogen activator (IV rt-PA) was contraindicated due to hemoptysis, MT was performed.

Endovascular treatment (**Fig. 2**): Treatment was initiated by groin puncture 241 minutes after onset and 33 minutes after arrival. A 9Fr Optimo (Tokai Medical Products, Aichi, Japan) was placed in the right internal carotid artery. Using a Penumbra ACE68 (Penumbra, Alameda, CA, USA), Trevo pro18 (Stryker, Kalamazoo, MI, USA), and CHIKAI 0.014-inch 200 cm (ASAHI INTECC, Aichi), the Trevo pro18 and CHIKAI were advanced across the lesion. The Penumbra ACE68 was placed in the proximal M1 segment of the right MCA. A Trevo 3 × 20 mm (Stryker) was deployed across the occluded area. Immediate flow restoration was observed. The Optimo was inflated, and the Trevo was slowly removed with continuous manual aspiration through

the Penumbra ACE68. A red thrombus of approximately 3 mm in diameter was retrieved. Thrombolysis in cerebral infarction 2B recanalization was achieved 40 minutes after puncture.

After the procedure, left-sided hemiparesis was rapidly improved. Left facial paresis, dysarthria, and left hemispatial neglect gradually disappeared, and ambulation became possible. Left-sided sensory disturbance remained. Pathological examination of the retrieved thrombus revealed squamous cell carcinoma cells along with fibrin (**Fig. 3**), and a diagnosis of stroke due to tumor embolism was made. On contrast-enhanced CT of the chest, a mass in the left hilar region infiltrating the pulmonary vein and left atrium was found (**Fig. 4**). Part of the invaded tumor and thrombus attached around it were considered to have caused embolism. As the

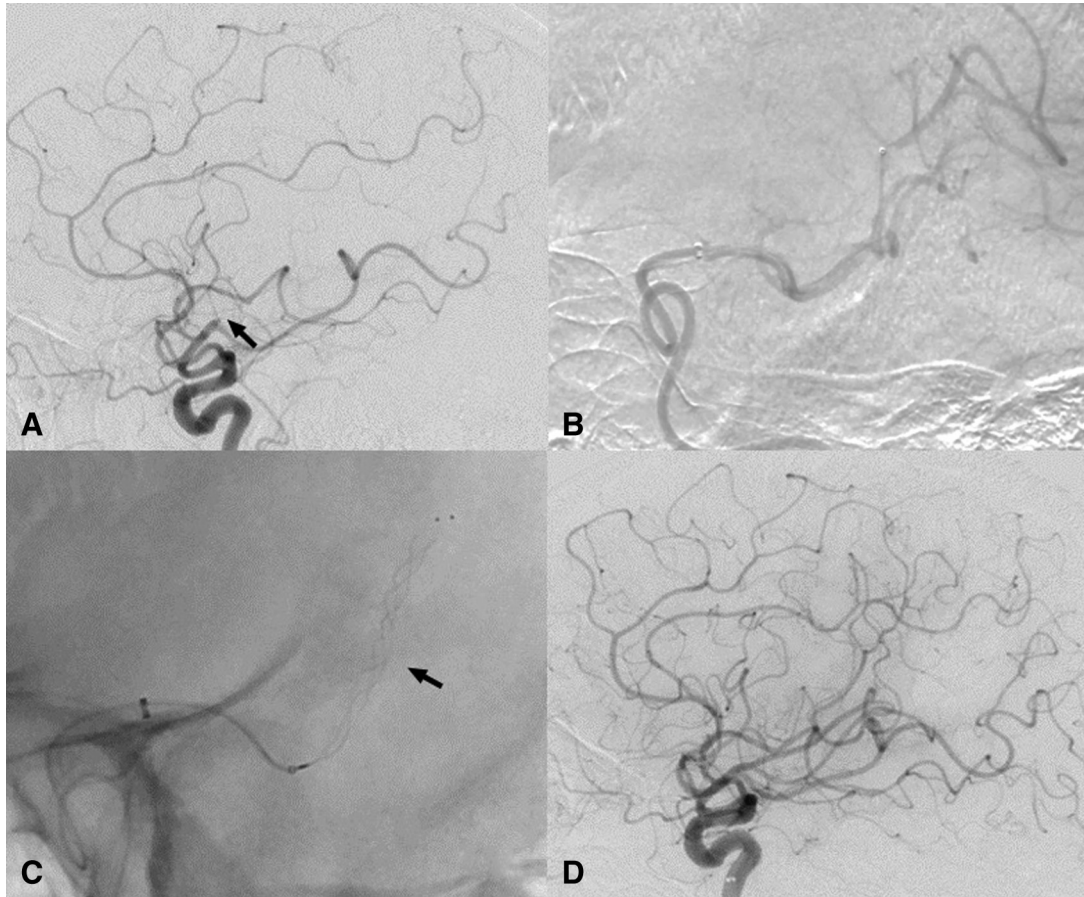


Fig. 2 (A) Right internal carotid artery angiography demonstrates occlusion of the right MCA M2 segment. (black arrow) (B) Dual injection angiography shows the occlusion site. (C) A Trevo 3 × 20 mm was deployed in the right MCA M2 segment. The black arrow shows the site of occlusion. (D) Post-thrombectomy angiography shows recanalization of the right M2 segment following a single pass of the stent-retriever and aspiration with the ACE68 catheter. MCA: middle cerebral artery

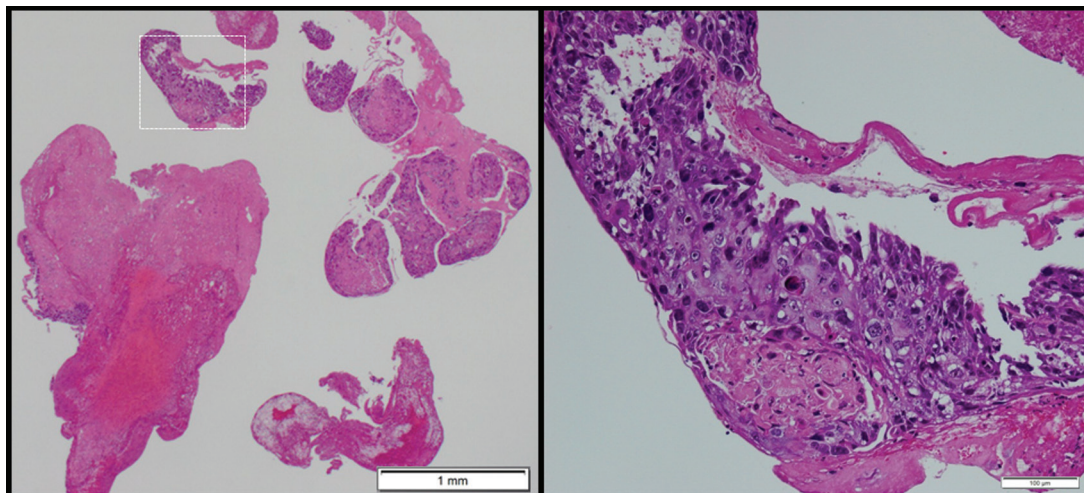


Fig. 3 Histopathology shows thrombus composed of fibrin and squamous cell carcinoma (hematoxylin–eosin staining)



Fig. 4 Chest contrast CT shows lung cancer invading the pulmonary vein and left atrium. CT: computed tomography

condition was complicated by paroxysmal atrial fibrillation, dabigatran was administered. The patient was transferred to the previous hospital for continuation of treatment for lung cancer 7 days after operation. The patient developed massive hemoptysis on the 36th postoperative day and died on the 40th postoperative day.

Discussion

We diagnosed a patient with tumor embolism by pathological examination of the thrombus retrieved by MT.

Due to the recent increase in patients with indications for MT, reports of detection of tumor cells by pathological examination of retrieved thrombi have been published. The 15 cases that have been reported are shown in **Table 1**.¹⁻¹⁴⁾

Cerebral embolism due to extracardiac tumor is considered to be caused by vascular infiltration of the tumor. In the present case, the tumor infiltrated the pulmonary vein and left atrium. Of the 15 reported cases of tumor embolism, 4 had extracardiac tumor. Of the four cases of extracardiac tumor, three had lung cancer infiltrating the pulmonary vein and left atrium,^{10,11,14)} and one had phyllodes tumor of the breast with pulmonary metastasis invading the pulmonary vein.¹⁾

The thrombus retrieved from our patient pathologically consisted of 70% thrombotic components and 30% tumor components. Ikeda et al.¹⁵⁾ treated patients with cerebral embolism due to myxoma of the heart by IV rt-PA therapy, and reported that the effectiveness of IV rt-PA was limited against emboli with a high tumor component percentage. IV rt-PA therapy was contraindicated in our patient because of hemoptysis, but considering the high percentage of

thrombotic components, recanalization may have been achieved if IV rt-PA therapy had been performed.

Concerning MT for tumor embolism, Tsurusaki et al.¹⁴⁾ reported that the hardness of the embolus is an important factor for recanalization, and that the push and fluff method using a Trevo was effective for a hard embolus of pulmonary squamous cell carcinoma. We also used the Trevo to treat our patient, deploying it by unsheathing, and were able to retrieve the embolus by one pass using the combined technique. Recanalization was considered to have been achieved easily because of the high percentage of thrombotic components and relative softness of the embolus.

Obtaining information about components of the embolus by preoperative imaging is beneficial for the prediction of the effectiveness of IV rt-PA, and selection of the device and technique for thrombectomy. Brinjikji et al.¹⁶⁾ reported that the positive susceptibility vessel sign on T2*-weighted imaging and the positive hyper-dense artery sign on CT are indications of a high percentage of thrombotic components in the embolus. Our patient underwent imaging examinations at the previous hospital, but as T2*-weighted imaging and CT were not included, these signs were not evaluated.

The thrombi retrieved from the four patients with cerebral embolization due to extracardiac tumors shown in **Table 1** were white and hard, and had different morphological characteristics from usual thrombi.^{1,10,11,14)} However, the appearance and elasticity of the embolus in our patient did not differ from those of usual thrombi. We initially considered the etiology of infarction to be cardiogenic cerebral embolism because of the history of paroxysmal atrial

Table 1 Summary of reported cases of diagnosed as tumor embolism by thrombo-pathology

Case	References	Age/Sex	IV rt-PA	Site of Occlusion	Technique of MT	Morphology of Clot	Pathology of Clot	Tumor
1	Bhatia (2010)	62 F	(-)	ICA top	SR	whitish and tissue-like and not like a normal clot in either appearance or texture	phylloides tumor of the breast	phylloides tumor of the breast
2	Tejada (2014)	64 F	(+)	MCA M1	SR	white granular surface of soft consistency and papilliform appearance	branching papillary lesions consistent with papillary fibroelastoma	papillary fibroelastoma
3	Baek (2014)	46 M	(+)	ICA/MCA M2	ADAPT/ADAPT	large amount of a gray, whitish-to-reddish	cardiac myxoma	cardiac myxoma
4	Placek (2014)	34 NR	(+)	MCA M1/M2	SR	gross appearance and consistency	tumorous embolus of myxoma	myxoma
5	Vega (2015)	11 M	(-)	MCA M1/Pcoma	CT/ADAPT	gelatinous and friable consistency	NR	cardiac myxoma
6	Ryu (2015)	34 M	(+)	MCA M1	CT	round, whitish, and elastic hard	tumorous tissue originating from a cardiac tumor	cardiac myxoma
7	Byon (2016)	55 M	(+)	ICA	ADAPT	yellow in color	high-grade undifferentiated sarcoma	unclassified sarcoma
8	Chung (2016)	4 M	(+)	MCA M1	SR	brown gelatinous material	cardiac myxoma	cardiac myxoma
9	Biraschi (2016)	75 M	(-)	MCA M1	ADAPT	1 cm white-pink hard tissue-like material	papillary fibroelastoma	papillary fibroelastoma
10	Zander (2016)	58 M	(-)	MCA M2	SR	small tissue fragment	undifferentiated non-small cell carcinoma of the lung	pulmonary adenocarcinoma
11	Zander (2016)	46 F	(-)	MCA M1	SR	NR	myxoma	cardiac myxoma
12	Pop (2017)	56 M	(-)	BA/ICA	CT	compact and purely tumorous/Both tumorous and thrombotic fragments	Sarcomatoid carcinoma	Pulmonary hilum tumor
13	Salam (2018)	25 M	(+)	MCA M1	SR	pale, white soft	papillary fibroelastoma	papillary fibroelastoma
14	Passhak (2018)	49 M	(-)	MCA M1	NR	NR	Liposarcoma	liposarcoma
15	Tsurusaki (2019)	72 M	(-)	ICA	SR	elastic and hard compared with that of intracardiac thrombus	Squamous cell carcinoma	Pulmonary squamous cell carcinoma
16	This case	64 M	(-)	MCA M2	CT	soft, red and thrombotic	Squamous cell carcinoma	Pulmonary squamous cell carcinoma

ICA: internal carotid artery; MCA: middle cerebral artery; Pcoma: posterior communicating artery; BA: basilar artery; IV rt-PA: intravenous rt-PA; MT: mechanical thrombectomy; SR: stent-retriever; ADAPT: a direct aspiration first pass technique; CT: combined technique; NR: not reported

fibrillation, but eventually diagnosed as tumor embolism based on pathological findings. It is important to proactively perform pathological examination of the retrieved thrombi because tumor cells may be detected even in apparently usual thrombi by pathological examination, leading to accurate subtyping of stroke. Pathological examination is considered particularly important for patients with a preoperatively unknown source of embolus, cancer patients, and patients with a history of cancer.

Conclusion

Tumor embolism due to extracardiac tumors is caused by vascular invasion of the tumor. Even when the characteristics of the retrieved embolus are similar to those of usual thrombus, pathological examination of the embolus may lead to accurate subtyping of stroke.

Disclosure Statement

The authors declare no conflicts of interest.

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