

## A case of metastatic brain tumor in the perfusion territory of superficial temporal artery-middle cerebral artery anastomosis

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### Abstract

**Background:** We report a rare case of metastatic tumor in the perfusion territory of superficial temporal artery-middle cerebral artery (STA-MCA) anastomosis.

**Case Description:** A 63-year-old man, who had undergone left STA-MCA anastomosis in the treatment of occlusion of internal carotid artery 4 years ago, presented with a hyperintense lesion on T2-weighted image in the left frontal lobe, the perfusion territory of the prior bypass. Follow-up magnetic resonance imaging 1 month later showed enhanced tumor within the T2 hyperintense lesion. A total removal of the tumor through another craniotomy was performed. The pathologic diagnosis was metastatic carcinoma.

**Conclusion:** This is the first report of the metastatic carcinoma by seeding of tumor cells through STA-MCA bypass flow.

**Key Words:** Metastatic brain tumor, superficial temporal artery-middle cerebral artery anastomosis, N-isopropyl-p-[123I] iodoamphetamine single photon emission computed tomography

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## INTRODUCTION

Superficial temporal artery-middle cerebral artery (STA-MCA) anastomosis, is performed for symptomatic ischemic cerebrovascular disease with hemodynamic hypoperfusion. Although the clinical contribution of STA-MCA anastomosis is still controversial this operation has been widely performed, especially in Japan, for the purpose of increasing cerebral blood flow (CBF).<sup>[1,3,6]</sup> Metastatic tumors are prone to occur in highly vascular regions; however, there has been no reported case harboring metastasis after bypass surgery. We experienced a rare case of metastatic carcinoma occurring within the perfusion territory of STA-MCA bypass. Pitfalls in the differential diagnosis of cerebral neoplastic lesions from cerebrovascular diseases are also discussed.

## CASE ILLUSTRATION

A 63-year-old man had undergone STA-MCA anastomosis for the treatment of left internal carotid artery (ICA) occlusion. He underwent annual follow-up magnetic resonance imaging (MRI) and single photon emission computed tomography (SPECT) after STA-MCA anastomosis.

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MRI performed at 4 years after the operation showed a newly-developed T2-hyperintense lesion in the perfusion territory of the bypass in the left frontal lobe [Figure 1a]. N-isopropyl-p-[<sup>123</sup>I] iodoamphetamine (<sup>123</sup>I-IMP) SPECT revealed the lesion as a perfusion defect area [Figure 1b] although MR angiography showed a good patency of the bypass [Figure 1c]. Nonetheless, ultrasound sonography showed no cardiac or arterial embolic source, so we suspected a cerebral infarction by hemodynamic ischemia and started an antiplatelet add-on therapy. The follow-up MRI 1 month later demonstrated clear enlargement of the lesion with ring enhancement by contrast-enhanced MRI [Figure 2a-c]. The mass lesion located in the left middle frontal gyrus, where computed tomography (CT) angiography exhibited the perfusion through the STA-MCA bypass [Figure 2d]. The tumor was totally removed without damaging the bypass graft. The pathologic diagnosis was metastatic carcinoma. The 18F-fludeoxyglucose positron emission tomography (FDG-PET) and CT scans detected the primary lesion in the mediastinum. The patient was transferred to the department of respiratory internal medicine for the treatment of the primary carcinoma.

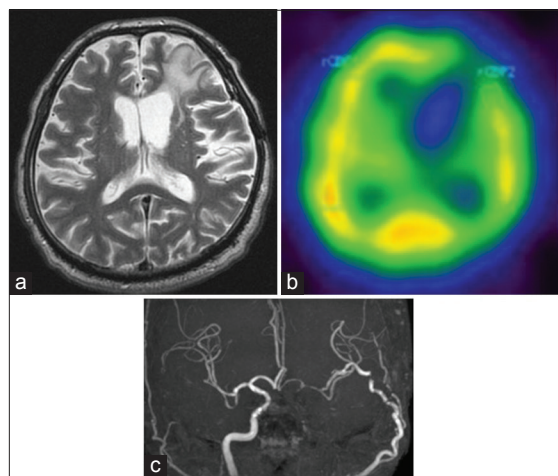
## DISCUSSION

STA-MCA anastomosis is performed for symptomatic ischemic cerebrovascular disease with hemodynamic hypoperfusion for the purpose of increasing CBF in the perfusion territory. As reported for various metastatic neoplasms within meningioma,<sup>[7]</sup> metastatic tumors are prone to occur in highly vascular areas. In the present case, we performed STA-MCA anastomosis to improve hypoperfusion after ICA occlusion. Postoperatively, a metastatic tumor arose in the perfusion territory of the

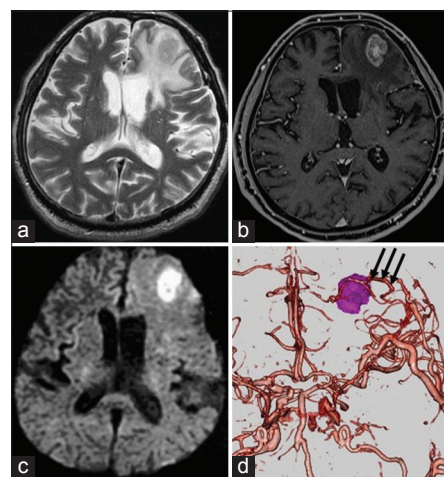
bypass. To our knowledge, this is the first reported case of a metastatic tumor developing in the perfusion territory of STA-MCA bypass flow.

In general, metastases occur preferentially at gray-white matter junctions and the vascular border zone (watershed) regions (62–64%), which are formed by the terminal capillary beds of cerebral arteries.<sup>[5]</sup> The capillary network and its low blood flow are the speculated causes of precipitation of the tumor emboli leading metastasis.<sup>[5]</sup> Ischemic events also occur frequently here because of the lower CBF. Consequently, vascular border zone areas are a hot spot where both infarction and metastasis preferentially occur. Differential diagnosis should be performed carefully for lesions developing in this region.

In the present case, the metastatic tumor was initially misdiagnosed as brain infarction because of the clinical history of cerebral ischemic disease and their radiographic similarities, hyperintense on T2-weighted image, and cold spot on <sup>123</sup>I-IMP SPECT. Finally, we obtained the accurate diagnosis through detection of radiographic changes on a follow-up MRI. <sup>123</sup>I-IMP SPECT is widely used for measuring regional CBF in the diagnosis of cerebral ischemia.<sup>[4]</sup> However, the use of <sup>123</sup>I-IMP SPECT for diagnosis of cerebral neoplasms is limited because even hypervascular tumors appear as cold spots except for malignant lymphoma.<sup>[2]</sup> The probability of ischemic lesions in our case should have been lower because of the CBF improvement by STA-MCA bypass. Neoplasms are possible differential diagnoses when the novel SPECT cold spot lesion occurs in the area where CBF has increased. To obtain an accurate radiographic diagnosis earlier, other sequences such as gadolinium enhancement or MR spectroscopy or FDG-PET would have been



**Figure 1:** (a) The initial T2-weighted magnetic resonance image showed a hyperintense area in the left frontal lobe. (b) N-isopropyl-p-[<sup>123</sup>I] iodoamphetamine single photon emission computed tomography revealed the lesion as a perfusion defect area (c) magnetic resonance angiography described patency of the bypass graft



**Figure 2:** (a) The follow-up T2-weighted image demonstrated a newly-developed mass in the enlarged high intensity lesion of the left frontal lobe. (b) Gadolinium-enhanced magnetic resonance image showed an enhancement effect of the mass. (c) The lesion appeared hyperintense on diffusion-weighted image. (d) Three-dimensional computed tomography-angiography exhibited the bypass flow (arrow) perfusing around the lesion

more suitable for the present case. The present rare case demonstrates a pitfall in radiologic diagnosis of cerebral lesions.

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### Conflicts of interest

There are no conflicts of interest.

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