



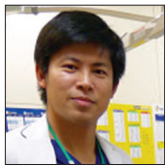
Case Report

Successful mechanical thrombectomy using a combined technique for internal carotid artery occlusion with persistent primitive trigeminal artery

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ABSTRACT

Background: The prevalence of persistent primitive trigeminal artery (PPTA) has been reported to be 0.1–0.6%. We report the successful recanalization of internal carotid artery (ICA) without embolization to new vascular territory (ENT) using a combined technique in a case of ICA occlusion with PPTA.

Case Description: A 65-year-old female presented with sudden consciousness disorder. The Glasgow Coma Scale score was 7 (E1, V1, M5) and National Institutes of Health Stroke Scale score was 28. Magnetic resonance diffusion-weighted imaging showed areas of high signal intensity in the left frontal lobe, parietal lobe, insular cortex, and corona radiata. Magnetic resonance angiography showed occlusion of the left ICA distal to a PPTA. We performed mechanical thrombectomy (MT) using a combined technique with a balloon guide catheter (BGC), aspiration catheter, and stent retriever and achieved complete recanalization without ENT. The patient experienced a good postoperative recovery course. At 6 months, her Modified Rankin Scale score was 2.

Conclusion: MT using a combined technique with BGC would be useful to prevent embolization to the posterior circulation through the PPTA in cases of ICA occlusion with PPTA.

Keywords: Acute ischemic stroke, Mechanical thrombectomy, Persistent primitive trigeminal artery

INTRODUCTION

The reported prevalence of persistent primitive trigeminal artery (PPTA) ranges between 0.1% and 0.6%.^[2,11,14] Acute ischemic stroke has been reported in patients with PPTA; however, most strokes were minor.^[3] There are few reports on major stroke due to large vessel occlusion (LVO) and on mechanical thrombectomy (MT) in patients with a PPTA,^[4,5,10] thus, the optimal MT technique in patients with LVO and a PPTA remains unclear. Embolization to new vascular territory (ENT) is a potential complication of MT.^[6]

If ENT occurs in a patient with a PPTA, the patient may suffer from basilar artery (BA) occlusion with poor outcome.^[13] Thus, an MT technique associated with a low risk of ENT is required.

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Various combined techniques using an aspiration catheter and stent retriever have been reported to show good results.^[7-9] We report a case of internal carotid artery (ICA) occlusion with PPTA who was successfully treated with a combined MT technique using a balloon guide catheter (BGC), an aspiration catheter, and a stent retriever.

CASE DESCRIPTION

A 65-year-old female presented with sudden consciousness disorder. She had a history of surgery for arterial septal defect closure, mitral valve angioplasty for mitral regurgitation, and coronary artery bypass graft surgery for coronary artery stenosis. Medications at the time of admission included clopidogrel 75 mg daily for coronary artery stenosis. Her Glasgow Coma Scale score was 7 (E1, V1, M5) and National Institutes of Health Stroke Scale score was 28. Electrocardiography revealed atrial fibrillation. Computed tomography of the head showed no evidence of early ischemic change. Magnetic resonance diffusion-weighted imaging (DWI) showed regions of high signal intensity in the left frontal lobe, parietal lobe, insular cortex, and corona radiata. The DWI Alberta Stroke Program Early Computed Tomographic Score was 5 [Figure 1a]. Magnetic resonance angiography (MRA) showed a left ICA occlusion distal to the PPTA. The vertebral arteries (VAs) and posterior communicating arteries (PCoAs) were hypoplastic bilaterally [Figure 1b]. Tissue plasminogen activator was not administered due to the large area of cerebral infarction. We elected to perform MT for the left ICA occlusion.

MT procedure

A 9 Fr sheath was inserted into the left femoral artery and a 9 Fr Optimo 90 (Tokai Medical Products, Kasugai, Aichi, Japan) was introduced into the cervical segment of the left ICA.

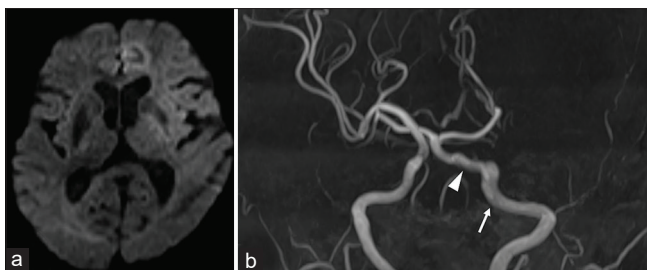


Figure 1: (a) Magnetic resonance diffusion-weighted imaging at admission showed regions of high signal intensity in the left frontal lobe, parietal lobe, insular cortex, and corona radiata. (b) Magnetic resonance angiography showed occlusion of the left internal carotid artery (ICA) (white arrow) distal to a persistent primitive trigeminal artery (PPTA) (white arrow head). The vertebral arteries and posterior communicating arteries were hypoplastic bilaterally. The bilateral superior cerebellar and posterior cerebral arteries were fed by the left ICA through the PPTA.

Digital subtraction angiography showed occlusion of the left ICA distal to the ophthalmic artery and a PPTA arising from the cavernous ICA that anastomosed with the BA below the origin of both superior cerebellar arteries (SCAs). The PPTA was feeding the BA and bilateral SCAs and posterior cerebral arteries (PCAs) [Figure 2a]. An AXS Catalyst 6 distal access catheter (Striker, Fremont, California, USA), Marksman microcatheter (Medtronic, Minneapolis, Minnesota, USA), and ASAHI CHIKAI 14 guidewire (ASAHI INTECC, Seto, Aichi, Japan) were inserted into the Optimo. The Marksman microcatheter was advanced to the distal end of the thrombus with the ASAHI CHIKAI 14. Subsequently, a Solitaire 4 × 20 mm stent retriever (Medtronic) was inserted into the Marksman microcatheter and deployed over the thrombus. After removal of the Marksman microcatheter, the AXS Catalyst 6 was connected to an aspiration tube and advanced to the proximal end of the thrombus. After inflation of the Optimo, we performed manual aspiration to achieve reverse flow. The Solitaire stent retriever and AXS Catalyst 6 were removed together [Figure 2b]. Digital subtraction angiography showed complete recanalization of the left ICA (thrombolysis in cerebral infarction grade 3). ENT did not occur [Figure 2c]. The time from puncture to recanalization and from stroke onset to recanalization were 21 and 201 min, respectively.

Postoperative course

DWI showed no new regions of infarction. MRA showed patency of the left ICA and PPTA [Figure 3a and b]. Warfarin was initiated for stroke prevention given the patient's history of mitral valve angioplasty. Her clinical course after MT was good; however, a mild right hemiparesis remained. After rehabilitation, the patient could walk unassisted. At 6 months after onset, her mRS score was 2.

DISCUSSION

The PPTA is a persistent carotid-vertebrobasilar anastomosis arising from the cavernous ICA and connects with the BA between the origins of the anterior inferior cerebellar arteries (AICAs) and SCAs. PPTAs are classified as medial or lateral according to their clinical course. The medial type enters the posterior fossa from a foramen in the dorsum sellae. The lateral type enters Meckel's cave, courses posteriorly, bends sharply medially, and connects to the BA.^[11] Our patient exhibited a medial type of PPTA.

Saltzman and Wollschlaeger classified PPTA into three types according to the degree of PCoA development.^[12] In type 1, PCoA is hypoplastic and both SCAs and PCAs are perfused by PPTA. In type 2, PCoA perfuses the bilateral PCAs and PPTA perfuses the bilateral SCAs. In type 3, ipsilateral PCA is perfused by PCoA and contralateral PCA is perfused by

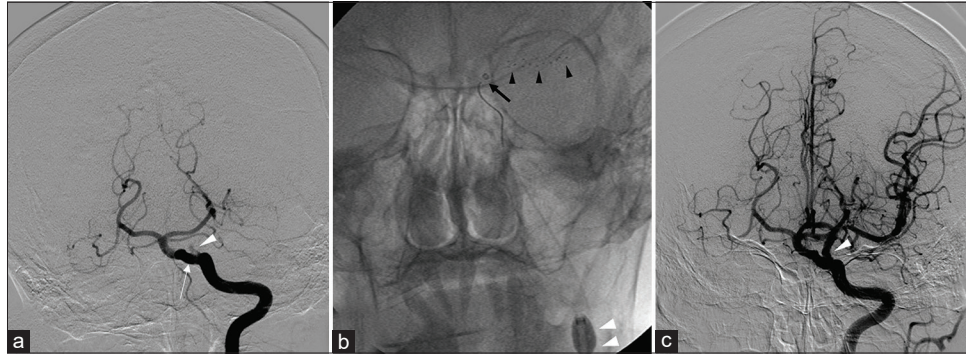


Figure 2: (a) Digital subtraction angiography (DSA) showed occlusion of the left ICA (white arrow head) distal to a persistent primitive trigeminal artery (white arrow). (b) The Solitaire 4 × 20 mm stent retriever (Medtronic, Minneapolis, Minnesota, USA) (black arrow heads) was deployed. The Marksman microcatheter (Medtronic) was removed and the AXS Catalyst 6 (Stryker, Freemont, California, USA) (black arrow) was introduced proximal to the thrombus. The 9 Fr Optimo (Tokai Medical Products, Kasugai, Aichi, Japan) was inflated (white arrow heads) and the Solitaire and AXS Catalyst 6 were removed together. (c) Postoperative DSA showed complete recanalization of the left ICA (white arrow head).

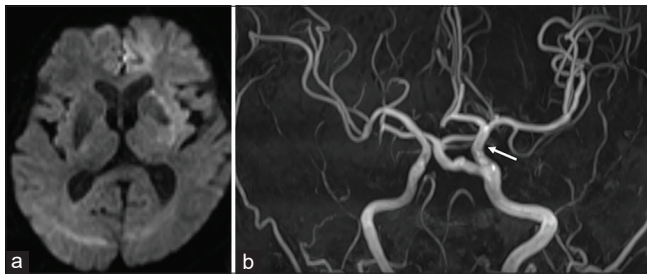


Figure 3: (a) Postoperative diffusion-weighted imaging showed no new cerebral infarction. (b) Postoperative magnetic resonance angiography showed complete recanalization of the left internal carotid artery (white arrow).

PPTA.^[12] More recently, Weon *et al.* classified PPTA into five types based on MRA findings.^[14] Weon types 1 and 2 are equivalent to Saltzman types 1 and 2, respectively. Weon types 3 and 4 are equivalent to Saltzman type 3. Weon type 5 represents a PPTA variant and is further classified into three subcategories according to the artery to which the PPTA is connected: type 5a, the SCA is directly connected to the PPTA; type 5b, the AICA is directly connected to the PPTA; and type 5c, the PICA is directly connected to the PPTA.^[14] In our patient, the PCoAs and VAs were hypoplastic bilaterally and the bilateral SCAs and PCAs were perfused by the ipsilateral PPTA. Therefore, our case was Saltzman type 1 and Weon type 1.

Hiramatsu *et al.* reported a patient with ICA occlusion with PPTA involvement who presented with ischemia of the posterior circulation.^[4] In their case, prior MRI was useful for diagnosis and direct aspiration using the Penumbra system (Penumbra Inc., Alameda, CA, USA) was performed.

Imahori *et al.* also reported a patient with middle cerebral artery and BA occlusion. MT using Merci Retriever

(Concentric Medical, Mountain View, CA, USA) for BA occlusion was performed through PPTA because bilateral VAs were hypoplastic and PPTA was patent. In our case, the location of the occluded vessel was distal to the PPTA. Therefore, it was required to prevent ENT to the posterior circulation through PPTA. When ICA and BA occlusions coexist, the existence of carotid-BA anastomosis should be considered. It is necessary to confirm not only maximum intensity projection imaging but also multiplanar reconstruction imaging of MRA.

MT techniques capable of achieving a high rate of complete recanalization with a low ENT rate have been reported. The BGC contributes to recanalization and prevention of ENT.^[1] Combined techniques, such as the aspiration-retriever technique for stroke, continuous aspiration before intracranial vascular embolectomy, stent-retriever assisted vacuum-locked extraction, and stent retrieving into an aspiration catheter with proximal balloon, which use both aspiration catheter and stent retriever, are also useful.^[7-9] Because prognosis may be worse if the thrombus moves to the BA through the PPTA,^[13] we decided to perform a combined technique using a BGC, which was successful. In case of embolization to the posterior circulation through the PPTA, MT can be performed through the PPTA if it is large enough to deliver the device.^[5,10] However, safety is not fully ensured. Furthermore, a posterior circulation approach is difficult, as 75% of patients with a PPTA also have moderately or severely hypoplastic PCoAs, VAs, and BA.^[11] Therefore, it is important to avoid and prevent BA occlusion.

CONCLUSION

Clinical symptoms and imaging findings are often atypical in the cases of ICA occlusion with PPTA and correct diagnosis may be difficult. A combined MT technique using a BGC

would be useful to prevent ENT to the posterior circulation through the PPTA.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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