

A Direct Aspiration First Pass Technique for Basilar Artery Occlusion Caused by Elastic-hard Tumor Embolus via the Pulmonary Vein by Metastatic Prostate Adenocarcinoma: A Case Report

Asaya NISHI,^{1,2} Yuko GOTO,^{1,3,4} Kazunori YAMANAKA,^{2,5}
and Haruhiko KISHIMA¹

¹Department of Neurosurgery, Osaka University Graduate School of Medicine, Suita, Osaka, Japan

²Department of Neurosurgery, Fuchu Hospital, Izumi, Osaka, Japan

³Department of Neuromodulation and Neurosurgery, Osaka University Graduate School of Medicine, Suita, Osaka, Japan

⁴Yu Neurosurgery Clinic, Toyonaka, Osaka, Japan

⁵Yamanaka Neurosurgical Rehabilitation Clinic, Osaka, Osaka, Japan

Abstract

Basilar artery occlusion (BAO) accounts for only 1% of all strokes, and cerebral infarction resulting from tumor emboli has been infrequently demonstrated; therefore, few reports described BAO due to tumor embolus and its treatment experience. We report here an 83-year-old man with an acute BAO caused by embolized lung tumor invading right pulmonary vein that was revealed as metastasis of prostate adenocarcinoma. The patient underwent rapid recanalization through acute thrombectomy with a direct aspiration first pass technique (ADAPT) with Penumbra catheter. Successful recanalization was achieved in reperfusion grade of thrombolysis in cerebral infarction (TICI) 2b, and the embolus revealed a highly elastic hard tumorous mass of which texture was too tough to be caught by stent retriever. Immunohistopathologic examination of the embolus revealed adenocarcinoma of the prostate. In spite of that the recanalization was obtained, the patient died of the brain stem infarction after 7 days from the onset. We experienced a rare case of acute BAO caused by embolized prostate cancer metastasizing lung and invading pulmonary vein. When we face to patients with lung tumor invading pulmonary vein, tumor embolus should have been strongly considered and aspiration thrombectomy may be safer and more effective for the condition because of the difficulty of predicting an embolus's texture before treatment.

Keywords: basilar artery occlusion, tumor embolus, pulmonary metastasis, prostate cancer, a direct aspiration first pass technique

Introduction

Previously published studies have shown that patients with basilar artery occlusion (BAO) are rare entities with reported incidences of 1% of all strokes, and the prognosis of BAO is poor among all the ischemic stroke subtypes.^{1–3)} Among the

patients with large vessel occlusion, the occlusive thrombi mostly were clots or atherosclerotic plaque; however, there were a few reports describing cerebral embolism originating from tumor emboli.^{4–7)} Tumor emboli generally occur in patients with cardiac tumor,^{8–11)} pulmonary cancer,^{4,5,7)} or focal cerebral metastatic tumor,⁵⁾ and previous case report demonstrated the successful recanalization by mechanical thrombectomy.^{8,9)}

Recent advances in endovascular therapy contribute the therapeutic option for acute BAO^{12–15)} and early, successful with safety method at removing thrombotic material has been required. Early recanalization

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results in better clinical outcome^{1,3,13}; however, the low incidence of BAO and different treatment approaches had made difficult to determine the efficacy and safety of which technique would be the most effective for the recanalization.

To date, multiple randomized controlled trials have demonstrated the efficacy and safety of mechanical thrombectomy for the patients with BAO in the literature, and the choice of a direct aspiration first pass technique (ADAPT) achieves a significantly higher rate of complete reperfusion with a shorter procedure duration compared to stent retriever.^{16,17} While these devices differ with regard to where they apply force on the thrombus to achieve successful recanalization, BAO due to tumor emboli would be quite difficult to decide treatment strategy because of its rarity.

This report describes a rare case about the patient with acute BAO caused by embolized prostate cancer metastasizing lung and invading pulmonary vein, ADAPT was effective for achievement of recanalization.

Case Report

An 83-year-old man with a history of prostate cancer presented to emergency department with stomachache and contrast enhanced computed tomography (CT) scans showed right pulmonary vein invasion by 4 cm cancerous mass suspected with metastatic tumor (Fig. 1). The CT scans also demonstrated that the patient had peri-cholecystic abscess, and laboratory data on admission showed elevation of white blood cell (WBC) counts and C-reactive protein (CRP) levels. Therefore, drainage for the peri-cholecystic abscess was performed and the patient improved his general condition after the drainage. Eight days after the admission, the patients suddenly became unconscious and emergent magnetic resonance imaging (MRI) demonstrated that basilar occlusion with acute brain stem infarction with the Diffusion Weighted Imaging Alberta Stroke Program Early Computed Tomography Score (DWI-ASPECTS) was 10 (Fig. 2a). Laboratory data did not show any elevated D-dimer levels, or abnormality in coagulation system. We planned urgent endovascular treatment, however, the patient's family members were not available then, and took a few hours in decision making of the patient's medical treatment because of the patient's cancerous status. Finally, informed consent was obtained and endovascular treatment was initiated after 4 hours from the onset of unconsciousness.

Intravenous thrombolysis therapy, a recombinant tissue plasminogen activator (rt-PA), could not be administrated because of its therapeutic time window, acute thrombectomy with ADAPT were performed. We confirmed basilar artery was occluded from



Fig. 1 Chest computed tomography showing metastatic lung tumor invading pulmonary vein.

proximal portion (Fig. 2b), then, guiding catheter (8Fr RoadMaster STR 90cm; GOODMAN, Nagoya, Aichi, Japan) was placed in the right vertebral artery. We gently advanced the Penumbra system, the 5MAX ACE (Penumbra, Inc., Alameda, CA, USA) to the face of the embolus over a 3MAX reperfusion catheter (Penumbra, Inc.) until wedged tightly. Continuous manual aspiration was performed with maintaining the vacuum state between the tip of the catheter. The aspirated embolus was, however, a white highly elastic hard tumorous mass (Fig. 3). Then we brought the patient's chest CT scans demonstrating 4 cm mass invading pulmonary vein to our mind and it suggested that the embolus was a tumor mass from pulmonary vein through the arterial system. Recanalization of basilar artery was achieved with the time of onset to recanalization was 345 minutes, and thrombolysis in cerebral infarction (TICI) grade was 2b (Fig. 2c). Immunohistopathologic examination of the tumor embolus revealed adenocarcinoma of the prostate (Figs. 4a and 4b). In spite of that the recanalization of basilar artery was obtained, the patient showed no improvement in neurological function. The patient's hemodynamics becomes unstable about 48 hours after the BAO; however, his family did not want additional medical treatment for him, and the elevated WBC counts and CRP never became normal with the appropriate treatment. Seven days after BAO, the patient died of the multiple organ failure.

Discussion

We presented a rare case of BAO caused by an elastic-hard tumor embolus from prostate cancer metastasize lung with invasion to pulmonary vein and ADAPT was an optimal treatment for the

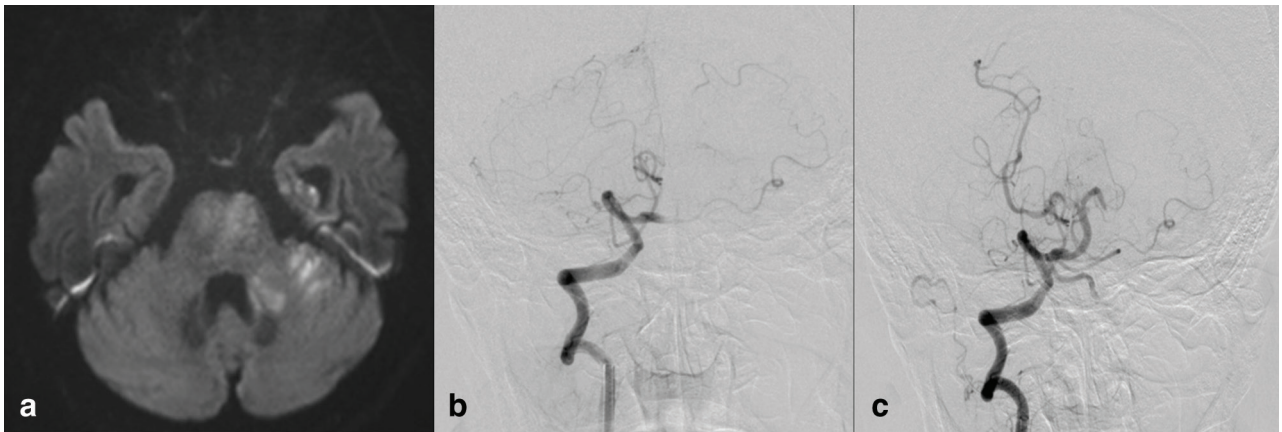


Fig. 2 (a) Axial diffusion-weighted image shows hyper-intense lesion involving the left cerebellum as well as pons consistent with basilar artery territory infarction. DSA images of a patient before (b) and after (c) thrombectomy. DSA of the left, dominant vertebral artery confirms proximal BAO. After thrombectomy, DSA images of the right demonstrated that recanalization of basilar artery was obtained in thrombolysis in cerebral infarction grade 2b. BAO: basilar artery occlusion, DSA: digital subtraction angiography.



Fig. 3 The aspirated embolus was a white highly elastic hard tumorous mass.

recanalization in this case. While the BAO accounts for only 1% of all stroke,¹⁻³ the percentage of metastatic lung tumor from prostate cancer was 3.6%¹⁸ and that means BAO due to tumor embolus from metastatic prostate cancer is very rare.

Arterial occlusion with stroke is relatively common among cancer patients. The association between cancer and thromboembolic disorders was first recognized by Trousseau in 1865 and named as Trousseau syndrome.^{19,20} The mechanism of Trousseau syndrome is known as malignancy-related hypercoagulability.²¹ In our case, Trousseau syndrome was not suspected as a cause of the BAO because the patient's laboratory findings showed normal coagulation status. We first suspected atherosclerotic plaque was the thrombus; however, the aspirated

mass, actually, were tumor emboli and immunohistopathologic examination revealed it to be prostate adenocarcinoma. Tumor emboli are reported as it occurs secondary to intracardiac tumors or noncardiac malignancy.⁴⁻⁷ According to an anatomical feature, if a metastatic lung tumor had an invasion to pulmonary vein, the tumor mass obtained access to the arterial system due to the pulmonary veins drain into the left atrium of the heart as well as intracardiac tumors.^{4,5} The common sites of tumor emboli are the aortic bifurcation or femoral vessels (50%) and the cerebral circulation (30%).^{6,7} The chest CT scans of the present patient would give us the prediction of the BAO due to tumor embolus from the lung tumor, however, we had no idea of that entity until we saw the tumor emboli obtained by the first aspiration.

The treatment strategy for the recanalization of BAO would be required careful consideration in the view of the safety of the procedure if the tumor embolus is such an elastic-hard tumor as that of present case. Even though recent randomized control trials have demonstrated the superiority of mechanical thrombectomy using stent retrievers to the patients with acute ischemic stroke,^{16,22} the procedural complication for all subtypes of acute ischemic stroke during endovascular therapy accounts for 3.5–16%,²³ while procedural complications during thrombectomy for BAO were not fully investigated. As for using stent retriever, device-related complications such as arterial dissection and vessel perforation when the microcatheter passes through the occluded site would result in hemorrhagic complications.²⁴ While major procedural issue of the

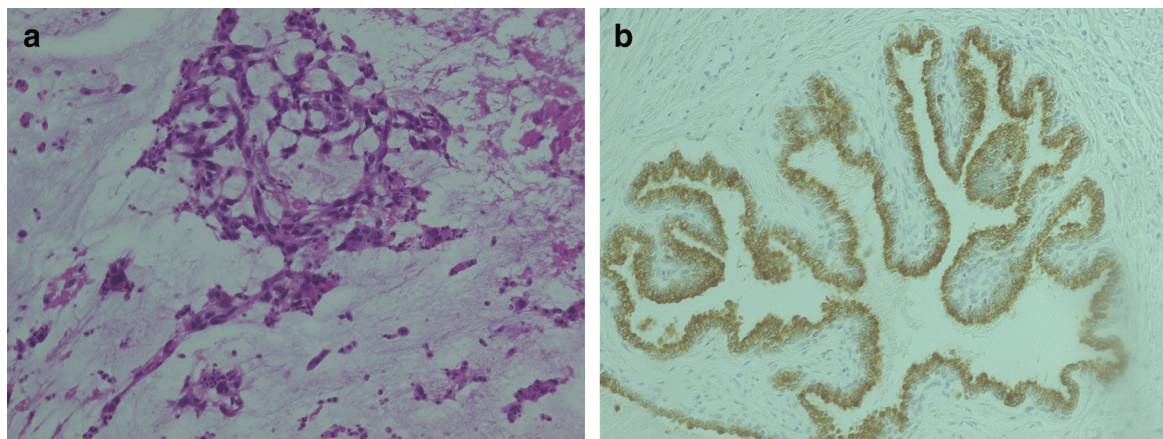


Fig. 4 Histopathology of the aspirated embolus obtained by thrombectomy from occluded basilar artery. (a) Hematoxylin and eosin staining of a thrombus fragment shows that main thrombus components are tumor cells with mild nuclear atypia and small nuclei. (b) Immunohistochemical staining indicates prostate-specific antigen positive in the tissue, which is compatible with a metastasis from the prostate cancer.

ADAPT technique for BAO is using the large catheter permitted by the vessel to ensure high-aspiration power for removal of the thrombus. Even though it has not been clear that which technique would lead more complications such as dissection or arterial rupture so far, ADAPT technique has been demonstrated an efficient procedure for BAO compared to stent retriever reported in the recent literature.²⁵⁾ In the technical point of view, ADAPT technique allows only a proximal engagement of the clot without the need of distal microcatheterization of the occluded vessel, and these observations suggest that the ADAPT technique would be an effective method for BAO due to unknown occlusive thrombi.

To achieve successful recanalization and to prevent procedural complications, the information regarding the distal portion of the occluded site is important. In such lesions, imaging findings only suggest a location and size of occlusive thrombi, without information about existing stenosis concerning characteristics of clots or the thrombi's texture. In the cause of thromboembolic occlusion, these occlusive thrombi were difficult to be visualized by diagnostic imaging tools such as MR imaging and CT scanning before thrombectomy. In the present case, there was no information about occlusive thrombi before thrombectomy therefore intravenous thrombolysis therapy such as rt-PA must have been ineffective and passing through the lesion with stent retriever would presume a risk of these complications due to the hardness of the emboli. Previously, Oshima et al reported that they had experienced hard thrombus that prevent expansion of the stent retriever the thrombus was difficult to be captured.²⁶⁾ Also, in case of failure with the first ADAPT

approach, the catheter can be used for introducing a stent retriever or another adjunctive device; therefore, ADAPT technique seemed to be the proper, first-line treatment in the present case.

The recanalization rates and treatment outcome of BAO are not fully understood. A retrospective review of 436 acute ischemic stroke patients who underwent mechanical thrombectomy using ADAPT revealed a reasonable treatment for the patients with acute BAO.^{13–15)} In the previous case reports about the mechanical thrombectomy for cardiac tumor and stent retriever,^{8,9)} ADAPT was successfully performed.^{10,11)} Regarding the present case, ADAPT technique would be recommended when the patient acute cerebral artery occlusion associated with a radiological finding of lung tumor invading pulmonary vein because the thrombi might be too hard to be grasped by stent retriever. The importance of the thrombi information was reported by Riedel et al suggesting that the shorter thrombi were easier to be removed by aspiration alone, leading to a better clinical outcome.²⁷⁾ Further development of imaging tools that can identify structural characteristics of thrombi is required and the information would be useful for treatment indication and strategy.

Regarding the efficiency and safety of treatment, the clinical benefit for the patient with acute ischemic stroke has been proven to be highly time-dependent, known as “Time Is Brain.”²⁸⁾ Rapid diagnosis and treatment can save lives of the patient with acute ischemic stroke. In addition, obtaining the informed consent to treatment should not be a time-consuming process. We tried to offer the thrombectomy as soon as possible; however, it took time to obtain the consent to treatment in the present

case. More evidence is needed and developing a structured and standardized informed consent process would be required so that improving both patient outcome and comprehension of the patient's family.

Conclusion

We experienced a rare case of acute BAO caused by embolized prostate cancer metastasizing lung and invading pulmonary vein. If patients with acute stroke have lung tumor invading pulmonary vein, we should consider the possibility that tumor embolus would cause the cerebral artery occlusion and aspiration thrombectomy may be the first approach for the condition because of the difficulty of predicting an embolus's texture before treatment.

Conflicts of Interest Disclosure

All authors have no conflict of interest.

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Corresponding author: Yuko Goto, MD, PhD
Yu Neurosurgery Clinic, 1-1-7-1 Shinsenrinishimachi, Toyonaka, Osaka 560-0083, Japan.
e-mail: yu-neuro@yuncl.jp